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Battelle Technical Review

IN THIS ISSUE: The Industry of Discovery Needs a Science of the Future

VIGNETTE

ROGER L. MERRILL

Man has fashioned mechanisms and energy systems that have multiplied his physical powers many times. "Man is creating, too," says Roger L. Merrill, Battelle engineering physicist, "the elements that will similarly extend his mental powers. Our computers, high-speed communication links, and display and pattern-recognition devices have brought us to the threshold of a revolution in our methods of gaining and utilizing knowledge. Its effect will be to tremendously enhance our intellectual resources and to enable us to mechanize routine mental tasks. Mankind can only gain from such a change, yet we must recognize and prepare to deal with the social and economic impact such a revolution will have."

As he guides the broad activities of the Institute's department of engineering physics, Rog is ever aware of the impending changes. The activities of his department help to bring them about. His colleagues conduct research associated with solid-state electronics, electrical instrumentation, electron-tube development, computer design and operation of computer facilities, reliability engineering, systems engineering, human factors research, and electrostatic and other techniques for reproducing information.

Of the many interesting and significant accomplishments of Rog's colleagues, there is space to mention only a few. Especially significant has been the development of the controls for the 600-foot radiotelescope at Sugar Grove, West Virginia, and, at present, the technical surveillance of its construction. Recent notable achievements include invention and development of an electronic neutron dosimeter, and an auditory reader for the blind. Also noteworthy are studies of automatic checkout systems for missiles, the effects of automation upon the performance of the operator in man-machine systems, and continuing research on xerographic equipment.

Rog received his bachelor's and master's degrees in electrical engineering from Ohio State University. His professional activity began with the design of electrical equipment for the Autocall Company. Later he conducted research on guidance and control systems for missiles and participated in the design of aircraft electrical systems for Curtiss Wright.

His early studies at Battelle—he joined the staff in 1949—included participation in the development of automatic statistical control instrumentation, of analog computer components, and of magnetic materials for magnetic tape recording. He also was a member of the team which designed an electronic-component information center.

Rog's name appears on a dozen papers and articles and on seven patents. His interests have led to membership in the American Institute of Electrical Engineers, the Institute of Radio Engineers, the American Association for the Advancement of Science, and Sigma Xi. He recently received appointments as a member of the Ad Hoc Panel on the Manufacture of Advanced Electronic Systems and Components of the Materials Advisory Board of the National Academy of Sciences and as a member of the National Research Committee of AIEE.

Rog and his wife Liz (Esther Elizabeth) find their home full of activity, what with their children and grandchildren. There are Bette, mother of two, Janice, Chris, Kit, and Bobbi. All of them enjoy the family's boats. For more strenuous fun, Rog plays handball.

BATTELLE TECHNICAL REVIEW

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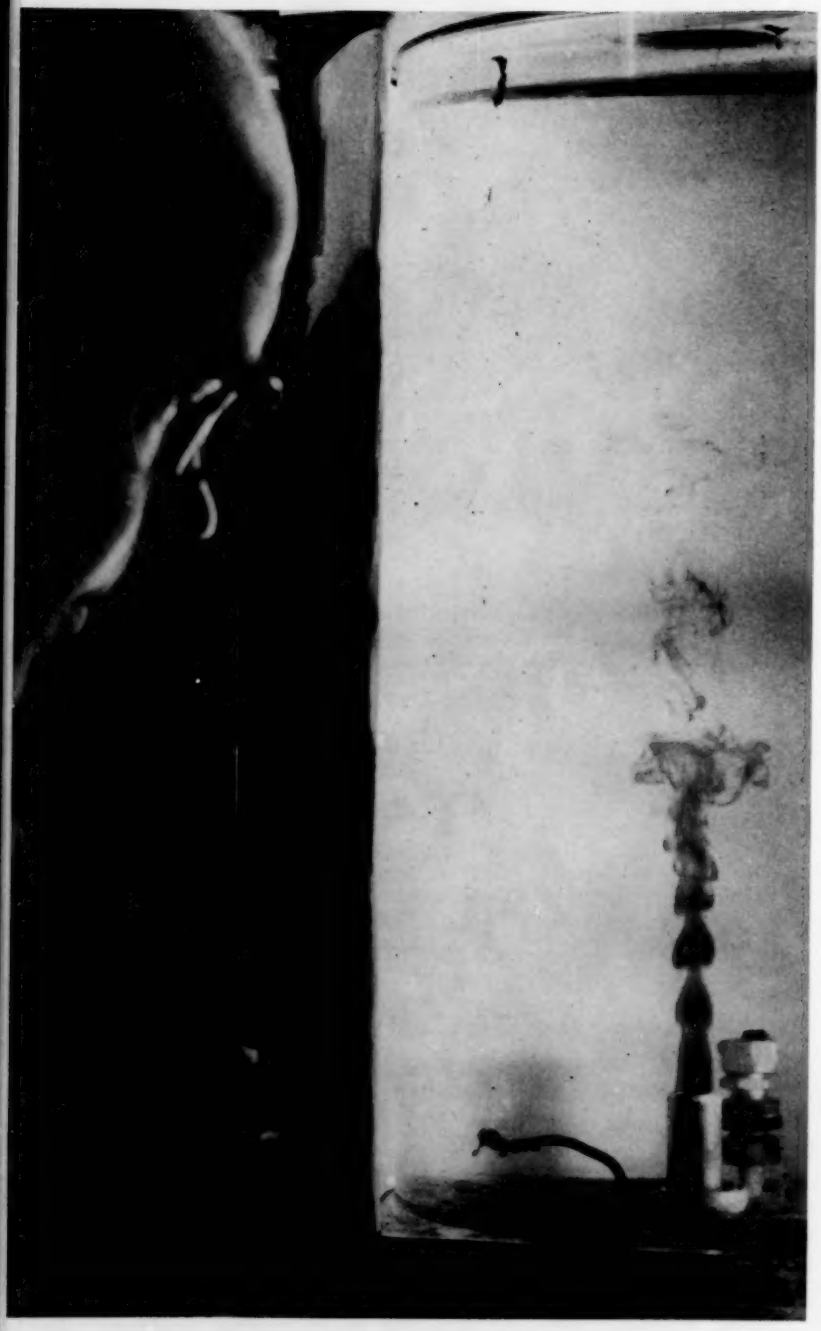
STUDY OF VORTICES



A vortex—for example a whirlpool—may be described as a whirling motion in a fluid body that results from interchanges of momentum between moving fluids on the one hand and stationary masses of fluids or physical obstructions on the other. Vortices, among other things, affect the flow of fluids in pipes, open streams, or in large bodies of liquids or gases. As they shed or break away from the point at which they are formed, vortices create disturbances in the fluid body through which they move, a fact which makes their study important.

Vortices are generally of two types. The so-called two-dimensional vortex, about which considerable information is available, is caused by fluid flow across rods or other extended obstructions. Much less is known about the axially symmetrical vortex, which is generally found when fluid flows in or from a regularly shaped container or when flow is around a symmetrical obstacle.

At Battelle, Abbott A. Putnam and Karl H. Rauch are studying axially symmetrical vortices, particularly. Because they wish to make visual observations of vortex formation and shedding, they utilize water in their experiments; its velocity is but one-twentieth that of air at the same Reynolds number. Their technique involves the flow of a stream of phenolphthalein-colored water through a tank of acidified water. This provides a needed source of heat at the reaction interface between the mingling liquids; the resulting buoyancy aids in the creation and shedding of vortices. At the same time, the acid dissipates the color so that the experiment can be clearly seen (see photo).

Putnam reports that observations to date have resulted in quantitative information on the effects of various unstabilizing influences on vortex shedding. Such data are expected to be helpful in solving problems associated with the effect of vortices on the flow of fluids around obstacles, on the distortions in flames, and on the boiling of fluids in closed containers.

NOTES from BATTELLE

✱ LANSING WATER RESOURCES STUDY

As the needs for water in metropolitan areas grow, the development of plans for water use assumes greater importance. Even in areas that now have no serious shortage of water, there is the possibility that future growth will bring on problems of water supply. It is such a possibility that is leading the tri-county Lansing, Michigan, area to study its water needs for the future. As a step in the general long-range planning for that area, Battelle is undertaking a comprehensive study to develop and evaluate alternative plans for use of water through 1980.

Battelle scientists will first concentrate on determining what alternative goals for the Area might be feasible, so far as regional resources and economic development are concerned. With these goals in mind, they will evaluate several alternative plans for using the Area's water resources. The study will take into account both the present character of the Area and what it might be like in the future, considering its resources, its location, and what the people want the Area to be.

Dr. James M. Jennings states that in studying the local water situation, the Battelle group will consider all aspects of water usage, including industrial, agricultural, municipal, and recreational.

✱ DETECTING SALMONELLA IN MICE

The important place of laboratory mice in the study of various types of human ills makes an understanding of diseases of mice essential. One of those diseases, which is widespread and which is receiving much current attention, is salmonellosis. The disease tends to attack an animal's liver, spleen, and portal and splenic veins.

A recent report by Battelle scientists Werner L. Margard, Arthur C. Peters, Jr., John H. Litchfield, and Richard S. Davidson along with Melvin S. Rheins of Ohio State University and Nicholas Dorko, discusses procedures for detecting the presence of salmonella, the organism responsible for salmonellosis in mice. They point out that the animals may carry salmonella as a constituent of their intestinal flora without any apparent sign of infection. On the other hand, mice may become obviously ill and die from the disease. When organisms are present in a mouse population, an outbreak of salmonellosis is always a possibility.

The study, supported by the Cancer Chemotherapy National Service Center of the U.S. Public Health Service showed that the detection of salmonella is complicated by the presence of other organisms in mouse feces. Indeed, the scientists found that a ratio possibly as high as 15 salmonella to every lactose-fermenting organism was needed in order to get a typical reaction on a plate medium.

The best detection method revealed by the study calls for these steps: (1) enrichment of the fecal samples in selenite broth plus cystine; (2) after an incubation period, streaking of the samples on brilliant-green agar; and (3) after further incubation, transferral of suspected salmonella colonies to triple-sugar iron-urea agar for added growth and final confirmation. The scientists found that fecal samples from individuals gave better results than pooled samples from a number of animals. Also, the first 6 fecal pellets excreted by an animal proved to have the highest incidence of salmonella.

✱ XENON DIFFUSION IN UO_2

Xenon's diffusion rate in uranium dioxide is still a matter of uncertainty in spite of numerous studies. In most experiments the releasing area has not been known, and uncertainty is increased because diffusion rates are greatly affected by oxygen-to-uranium ratios, variation in grain size, and other factors.

In studies at Battelle, for the U. S. Atomic Energy Commission, Russell H. Barnes, Mihkel Kangilaski, James B. Melehan, and Frank A. Rough conducted experiments with single crystal UO_2 to gain a better understanding of the true nature of the diffusion of xenon. An important aspect of their study was a series of steps to hold oxygen to a minimum in the specimens.

They found, in general, that there was significantly less diffusion of xenon in single crystals than in sintered specimens of UO_2 at 1400 C. More specifically, the diffusion coefficient of xenon in single crystals of nearly stoichiometric UO_2 was 2×10^{-17} cm^2/sec as

against 2 x 10^{-18} for sintered nearly stoichiometric specimens. At the same time, variations in grain size, from 2.2 to 24 microns, appeared to have no effect on the diffusion coefficient. The technologists believe that the much lower rate of diffusion in the single crystals is due to their greater crystalline perfection and lower impurity content.

* UO_2 KNOWLEDGE SUMMARIZED

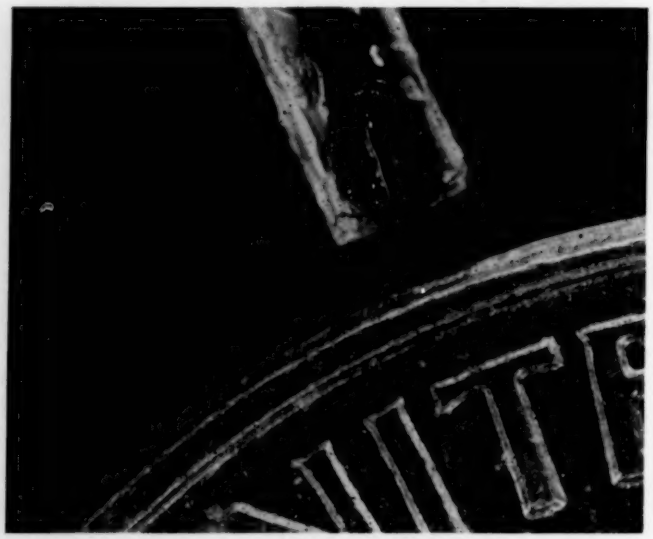
Dense uranium dioxide is the most important nuclear fuel for use in civilian power reactors. Published information on the subject is voluminous—almost chaotic. The Naval Reactors Branch of the Atomic Energy Commission's Division of Reactor Development, recognizing the need for an orderly and authoritative summarization of the subject, has just published the book, *Uranium Dioxide: Properties and Nuclear Applications.*

The 726-page book is an excellent summary of information on the applications, preparation, and fabrication of UO_2; its chemical, physical, mechanical, and thermodynamic properties; and on its characteristics that are especially important in reactor technology—solid-phase reactions, corrosion, and behavior in irradiation. It has been termed a "must" for anyone with an interest in reactor technology.

Battelle staff members have contributed extensively to what is known about UO_2. They conducted early studies for the Bettis Laboratory of AEC on UO_2 fuel for the Shippingport Reactor. Battelle studies have continued to the present, not only for the Bettis Laboratories, but for the AEC and many of its contractors, as well. The most recent Battelle accomplishment has been development of isostatic hot pressing, a new fabrication method for fuel elements. Using this method, Bettis Laboratories are now making PWR (pressurized water reactor) Core 2, which generates 2½ times the power of Core 1.

As an outgrowth of Battelle's diverse studies, seven Battelle technologists have prepared sections or chapters of the new book on UO_2. These authors include: Carl A. Alexander, Winston H. Duckworth, Manley W. Mallett, Jerry W. Moody, Herbert D. Sheets, Dale A. Vaughan, and Robert K. Willardson. J. Belle, editor of the work, is a former member of the Battelle staff.

The paper-bound volume is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., price $2.50.



This tiny plastic-mounted search coil (shown beside a penny) is used by technologists at Battelle to ferret out defects in small parts or in hard-to-get-at places in larger parts and to trace property variations within minerals. Like all such induction coils, this miniaturized version operates by measuring eddy and induction currents that may be present. Designed by Clifford L. Seale, the coil consists of 200 turns of number 56 wire (0.00065 inch in diameter, including insulation) wound on an 0.008-inch iron -wire core.

TWO TECHNICAL PAPERS prepared by Battelle electrochemical research specialists were among the award winners announced at the annual meeting of the American Electroplaters' Society, in Boston.

The Chromium Plating Award was presented to William H. Safranek and Robert W. Hardy for their paper titled "Use of Selenic Acid for Plating Microcracked, Protective and Decorative Chromium Plate". The Society's newly-established Zinc Award went to coauthors Hugh R. Miller, Robert W. Hardy, William H. Safranek, and Dr. Charles L. Faust for their paper titled "Data on the Corrosion Resistance of Electroplated Zinc Die Castings".

RESEARCH SCIENTISTS AND INDUSTRIAL MANAGEMENT people have much in common, states M. R. Nestor in a printed discussion entitled "Can the Research Scientist Acquire a Management Attitude?" Nestor is Battelle's manager of project development. He points out that the typical research technologist wants to see the results of his work applied to industrial production and social betterment. For this reason, research men acquire an understanding of economics and encourage particularly those projects that will meet economic and technological needs. Copies of the statement may be obtained from the Battelle Publications Office, 505 King Avenue, Columbus 1, Ohio.

The Industry of Discovery Needs a Science of the Future

The better we can forecast the economic environment of the future, the more effective will be long-range planning for research and development activities.

by GEORGE W. JAMES

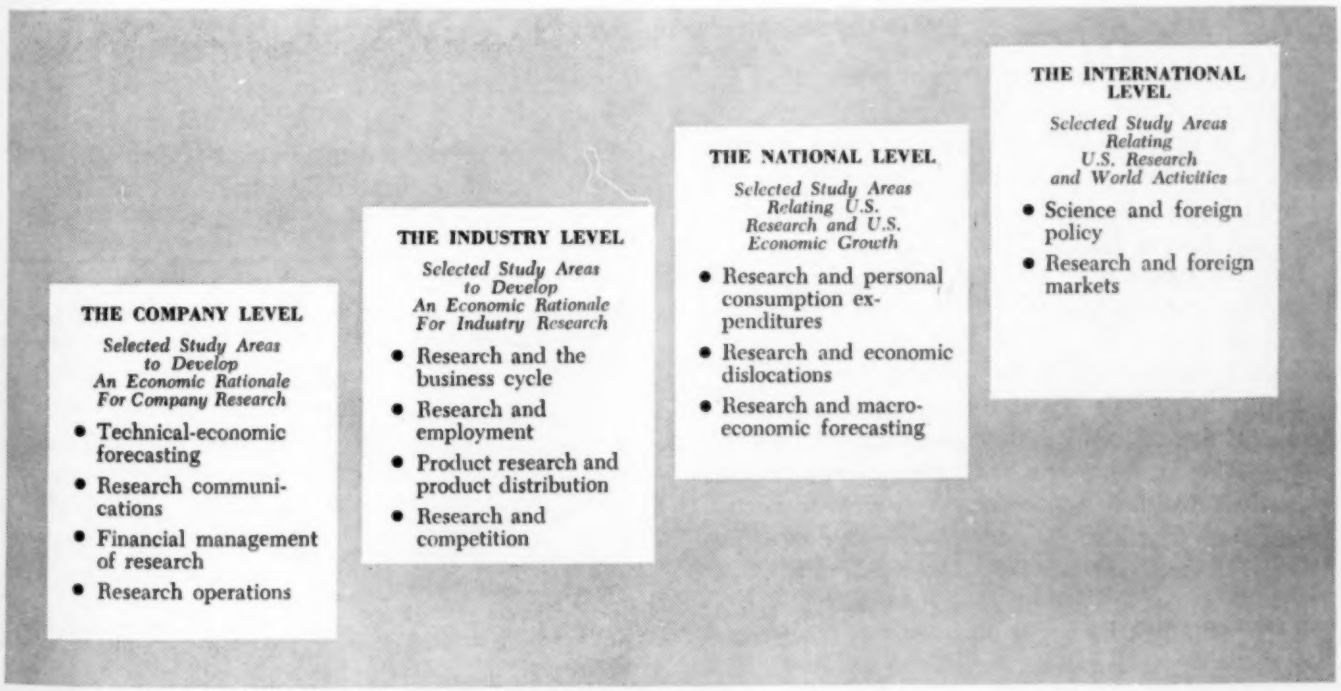
MOST EFFECTIVE MANAGEMENT of corporate applied research is achieved by joining the *technical* and *economic* considerations. The relationships between scientific research and economics can be studied at many levels—from a company, to an industry, to the economy as a whole, and to the international plane. Below is an illustration of the four major levels of research-economics interaction with general topic areas shown for each level.

AN ECONOMIC RATIONALE FOR COMPANY RESEARCH

The research activity within a company is influenced by the standard factors of production—dollars, personnel, facilities, and management skills. But, although the factors influencing research are similar to those of other company activities, the application and control of these factors in the research activity differs significantly from their use in any other company function.

The *time differential* involved is the primary reason for this difference. Research is an investment in ideas and experiments which precedes perhaps by many years the "hardware" investment required to exploit its results. Thus, the return on research expenditures is further removed in time than the return on any other investment of the company, with the possible exception of natural resources held for future demand.

The box on page 6 shows several major areas of research-economics study at the company level: Technical- economic forecasting, research communications, financial management of research, and research operations. Each of these areas of study offers the potential for development of improved application and measure-


THE COMPANY LEVEL
Selected Study Areas to Develop An Economic Rationale For Company Research
• Technical-economic forecasting
• Research communications
• Financial management of research
• Research operations
THE INDUSTRY LEVEL
Selected Study Areas to Develop An Economic Rationale For Industry Research
• Research and the business cycle
• Research and employment
• Product research and product distribution
• Research and competition
THE NATIONAL LEVEL
Selected Study Areas Relating U.S. Research and U.S. Economic Growth
• Research and personal consumption expenditures
• Research and economic dislocations
• Research and macroeconomic forecasting
THE INTERNATIONAL LEVEL
Selected Study Areas Relating U.S. Research and World Activities
• Science and foreign policy
• Research and foreign markets

The four major levels of study relating research and economic activities

MAJOR AREAS OF RESEARCH-ECONOMICS STUDY AT THE COMPANY LEVEL

- **Technical-Economic Forecasting**
  - A. The economic forecast
  - B. The technical forecast
  - C. The technical-economic forecast
  - D. The company long-range plan.
- **Research Communications**
  - A. Use of marketing information in scientific research
  - B. Values of a "research minded" company.
- **Financial Management of Research**
  - A. Desired methods for budgeting for research
  - B. Future methods for budgeting for research
  - C. Research "overhead" costs
  - D. Effect of the corporate tax structure on research
  - E. Assessment of the financial decisions to be made throughout the research process.
- **Research Operations**
  - A. Measurement of research efficiency
  - B. Research related to company productivity.

ment of research—an economic rationale for company research. And each area is influenced by the time differential.

Technical-Economic Forecasting

Many companies do long-range planning. But few use long-range forecasts to determine what research is needed to strengthen their future positions. Current technical-economic evaluations are clouded by the lack of even basic information on the economic environment anticipated for (and from) current research.

Effective long-range planning demands that *both* research and economic factors be isolated and studied. Then the two contribute to the long-range plan in balanced relationship, as each affects the other.

Before a specific research project is undertaken, technical objectives of the company should be established. These must stem from a company's business objectives. Neither can be accurately defined without long-range technical-economic considerations. This, then, is the initial step in company research functions.

Research Communications

Marketing information can be one of the most valuable sources for guiding research efforts in a company. The new or improved products which emanate from research are valuable to the company only when they can be marketed profitably. Future market characteristics and volume can often be determined by the company's field marketing staff. Methods for developing marketing information for communication to and coordinating with research departments are a major objective of the field of research economics.

Development of research communications broadly within a company contributes to a "research orientation". It encourages useful contributions from personnel in finance, production, sales, and engineering. Changes and innovations in a company should not be confined, but rather diffused throughout the company.

Financial Management of Research

A common way to decide how much to spend for research is to allocate a certain percentage of sales; or to match competitive effort. These measures are usually not adequate. Research appropriations should result from technical-economic forecasts which define needs and reveal opportunities.

How much research effort should be expended by a company of a specific size (involved in a specific number of products and a particular type of competition) has not been reduced to formula. Yet, it seems reasonable that certain guide lines could and should be developed relative to the company's research effort.

No single factor would appear to be sufficient. It cannot be said that a company doing less than $50 million in annual sales should not be concerned with research. Also, it might be questionable whether a company with more than $1 billion annual sales should be devoting as much as 9 per cent of its sales to research. Instead, some measure of the state of technology in the scientific field related to the company's business in-

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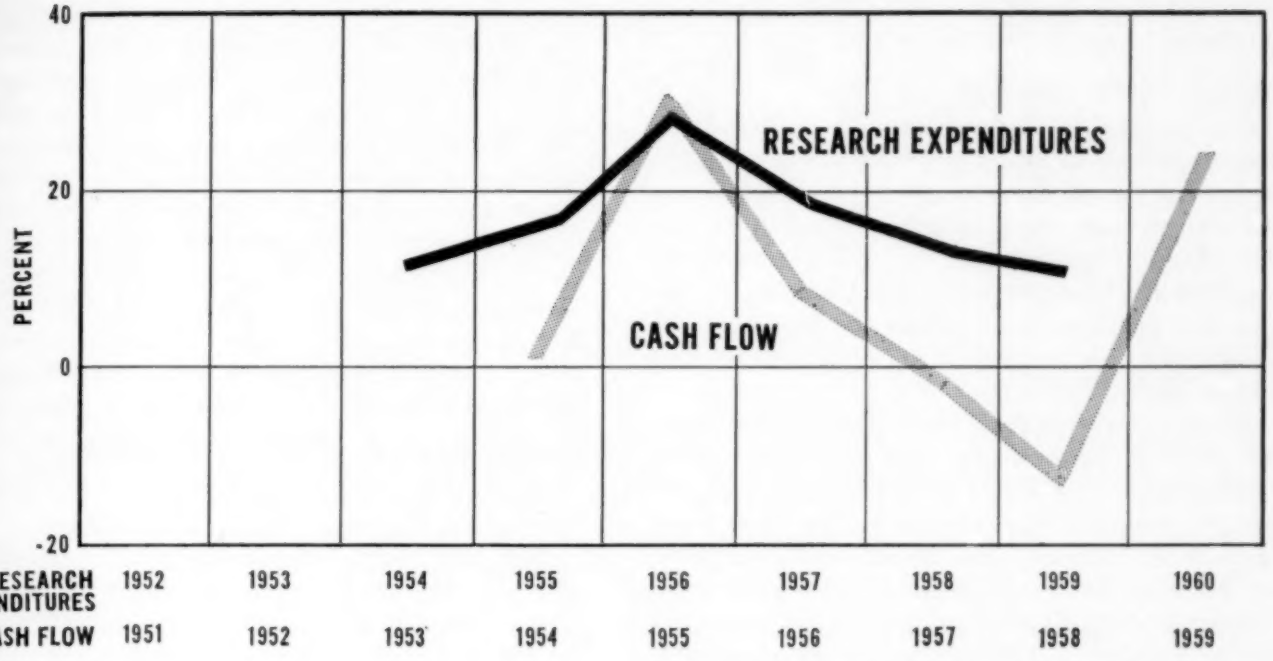
Dr. Jame's article on the relationship of research and development to corporate long-range planning is reproduced from a recent limited printing. The author, who leads the research economics group at Battelle, is currently pursuing studies of the relationships between research and economic growth. In earlier years, he participated in a number of technical-economic studies which included the economics of ferrous scrap in the iron and steel industry, methods of improving time-deposit accounting in the banking industry, and problems of predicting the state of the art in technology. James, who received his Ph.D. degree in economics from Georgetown University, is chairman of the Program Committee of the National Association of Business Economists.



RESEARCH EXPENDITURES	1952	1953	1954	1955	1956	1957	1958	1959	1960
CASH FLOW	1951	1952	1953	1954	1955	1956	1957	1958	1959

Source: Research Economics Group, Battelle Memorial Institute

Relation of research expenditures to cash flow of manufacturing corporations (percentage change from year to year)

terests should be developed to assure effective research.

Then, too, means for generating and controlling research dollars can be more important than amounts. Time dimension is involved in these areas. As an investment in the future, research cannot be financially managed day by day—as, for instance, the purchase of raw materials. Yet many companies attempt to do so. Such an attitude clashes with the inherent nature of research—distant time phasing for exploring what is not known.

Battelle studies suggest that a major determinant of expenditures for research is the internal cash flow (net profits retained in business plus depreciation). Few companies have found a way to borrow funds for the express purpose of doing research. Evidence suggests that the time lag between the generation of the cash flow and the research expenditure is from 3 to 5 quarters. The graph above shows these relationships.

Because of the nature of research, it should be planned well beyond one-year periods. If cash flow monies were earmarked to research activities for at least a year ahead (preferably more), directors of research and development could strengthen programs. Improved measures of financial control could then be developed from the longer planning of research.

Research Operations

How to measure operating efficiency is a common problem in research operations. Much such effort in this area employs tools normally available in analyzing other company functions. For example, in production operation, factors for direct versus indirect labor, or fixed versus variable costs, are generally developed. Similarly, attempts are often made to apply such factors to research operations, a common error.

Actually, a *rise* in research "overhead costs" can be highly desirable. The rise may represent an increase in capacity of the professional research worker. If additional people and facilities improve the professional's ability to test an increased flow of ideas, then the additions are worthwhile. Thus, in some situations, it could be more effective to have two technicians for a single professional research worker, while in other situations two professional workers for each technician might be better. The needed ratio depends on the quantity of promising ideas needing further study and the most effective use of professional effort that can be devised.

An Economic Rationale for Industry Research

Economic considerations for research at the industry level may be substantially different from those at the company level, although there is a significant interplay. Below are given several major topics for consideration in the development of an economic rationale for industry research: research and the business cycle, re-

search and employment, product research and product distribution, research and competition.

Research and the Business Cycle

An area here that deserves study is the possibility that irregularity of innovations and changes through research is the principal contributor to the business cycle. Once more, the time differential must be considered. If relationships could be charted between research efforts of the past and current business activities, a method might be uncovered for regulating research so that its rate of activity would contribute to minimizing business fluctuations.

There is good reason to believe that one classical explanation of the business cycle may be outdated. Traditionally, it has been considered that changing inventory requirements contribute to aggregate movements in the business cycle. Consequently, inventories are studied in detail as indicators for the business cycle. Independent of this analysis, research has been working in a rather subtle fashion through automation, mechanization, and improved communications to permit a rapid reordering system. This has resulted in lower inventory requirements without loss in quality of customer service. Further study might indicate that due to research, inventory levels may not reach previous highs since wholesalers and retailers are operating efficiently with lower inventories.

Research and Employment

There are many reasons to suspect that past and current research efforts have a major impact on industrial operation. For example, it is said that automation and mechanization (largely a result of research) may be contributing to technological unemployment. Quite often this problem is minimized because, on the whole, over the past decade and a half, U.S. employment has been at a relatively high rate. However, unemployment may become a more critical question in the next 5 years. Yet it is abundantly clear that a substantial part of total employment comes from industries and products which are the result of research. More must be learned and understood about the effects of research on industrial labor in order that the labor transitions, which sometimes result, can be anticipated and made with a minimum loss of productivity.

Product Research and Product Distribution

Research-economics considerations at the industry level offer a perspective not available at the company or firm level. Take the case of product research and product distribution. Nearly all of the research carried on today by industry is product oriented. But for all products manufactured by industry there must be a service complex which transports, insures, communicates, maintains, and in general distributes the product to its ultimate consumer. The service industry complex is geared to accept products which are handed to it by the product-oriented industries. When there is a change in the product the service industry complex may not be ready to accommodate a change. Subsequently, irritations and dislocations are created in the service industry complex which require solutions. Frequently, the solution may come in the form of a price increase either in the product or in the service or both.

It may be that the service industries as a group need to take on a formal research posture of their own. This becomes particularly significant when it is considered that of all industry income in the U.S., approximately 55 per cent is identified with the service-oriented industries and only 45 per cent with the manufacturing or product industries.

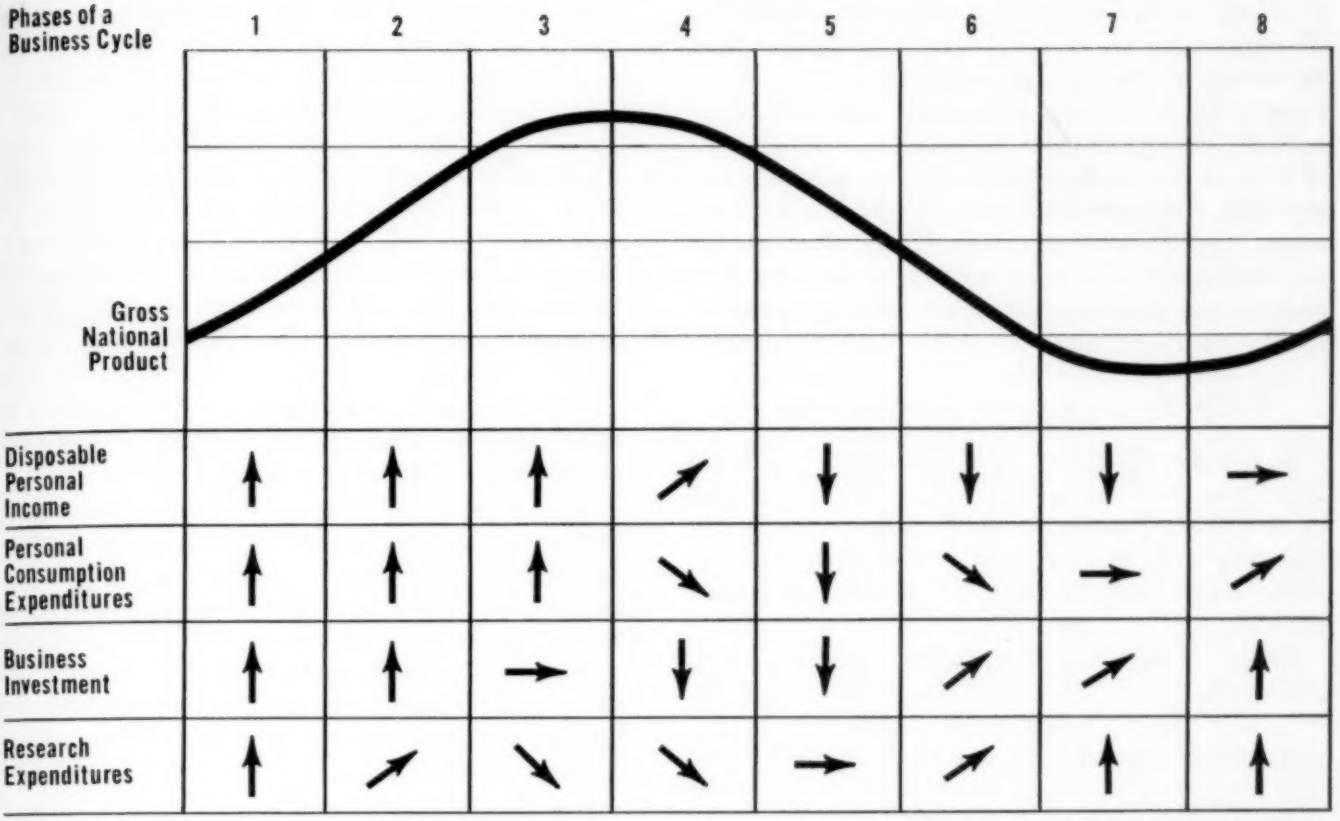
Research and Competition

Another area to be considered is the effect of research upon the competition within and between industries.

Antitrust laws, as originally written, conceived markets as being relatively fixed over a sustained period of time. Increasing technological efforts, however, may be changing markets so rapidly that a new interpretation is needed of the "relevant" market as defined through modern technology. For example, recent technological developments in plastics and nonferrous materials might reorient the thinking on what has been described as "steel" markets.

MAJOR AREAS OF RESEARCH-ECONOMICS STUDY AT THE INDUSTRY LEVEL

- **Research and the Business Cycle**
  - A. The relationships between the rate of innovations and the business cycle
  - B. The effect of research on lowering required inventory levels.
- **Research and Employment**
  - A. Technological unemployment
  - B. Research and productivity.
- **Product Research and Product Distribution**
  - A. Research as it affects the service industries
  - B. Development of a formal research complex for the service industries.
- **Research and Industry Competition.**



Source: Research Economics Group, Battelle Memorial Institute

A hypothetical illustration of the effects of business cycles on disposable personal income, personal consumption expenditures, business investment, and research

Research and U.S Economic Growth

There are a large number of important areas which require study at this level. A few of the more prominent areas include the effect of research on: changing levels of personal consumption expenditures, creating major dislocations in the economy, and macro-economic forecasting.

The magnitude and distribution of personal consumption expenditures must ultimately have an effect on research. It is well known that there is a strong trend today toward learning more about what motivates the consumer and developing patterns for his buying habits. As this information is gathered and analyzed, it might be possible to trace its relationships back through the production cycle to research. The chart above is a concept of the possible relationship.

That chart again points up the problem of the time differential involved in research. The fact that the relationships between changing levels of personal consumption expenditures and research effort are several steps removed from one another means that research efforts of the past are related to present day buying habits. Or the research being done today (or under consideration) will be related to the changing buying habits of the consumer at some time in the future.

Since the objective of scientific research is to uncover and use information not yet known, it is logical to expect that research's aggregate effect on the economy at any one time is to invoke some major economic change. These changes may be viewed as dislocations to the economy, either favorable or unfavorable. Some of the dislocations include: technological unemployment, changes in stock market buying practices (investments in "research minded" companies), considerable shortening of the time any one industry or company can hold a market (technological obsolescence as it relates to monopolistic or oligopolistic competition), and the "programmed" consumer who must be prepared to evaluate far more products in a short period of time to make a favorable decision. Few, if any, of these problems have been set down in organized form for analysis and better understanding of aggregate research economics.

It is possible that research is a major hope for U.S. economic growth in the 1960's. The kind of research promoting economic growth would be that which

effectively led to new products and services which the consumer needs but does not have at the present time. An automatic pilot in a car, safe and reliable, would be an example of a new plateau of products through research. Perhaps the fuel cell which might abolish all of the umbilical cords to the house, the electrical lines, gas lines, telephone lines, etc., would be another example. Again, however, major dislocations in the economy could take place with the introduction of such radical products. Anticipation and preparation for this possibility should be made.

U.S. Research and World Activities

Any major effort, such as U.S. research, which affects the nation's economy, in turn, will have an impact on the U. S. position in world affairs. Among the major topics to be considered at this level would be research and foreign markets and science and foreign policy.

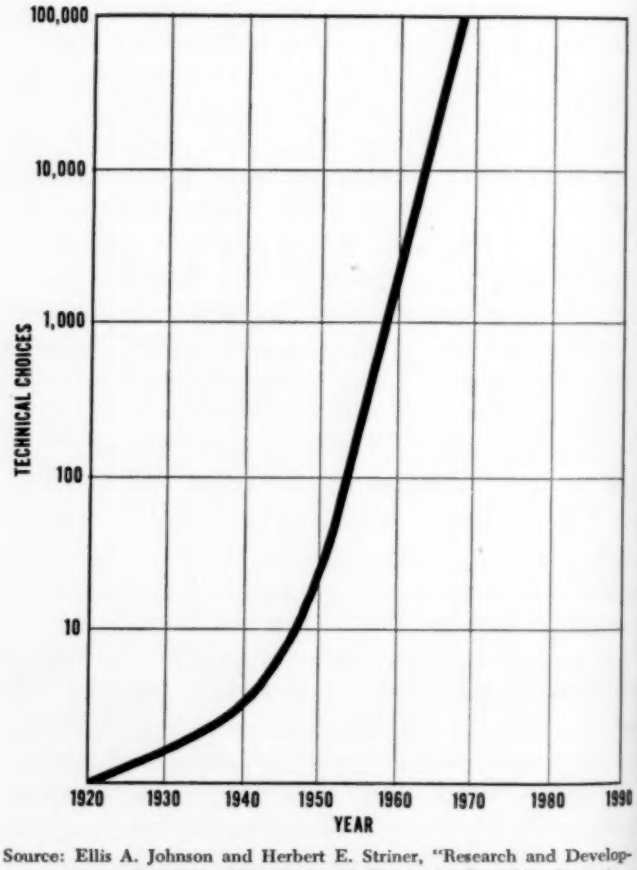
Following World War II, world markets for U.S. goods were essentially ready-made. In many areas the U.S. was the only source of supply for needed products and services abroad. Few, if any, U.S. products were developed and manufactured solely for the purpose of foreign markets. This situation contributed to our stiff foreign competition today, due perhaps to a lack of planning on the part of U.S. producers. Similarly, to avoid a like situation in the future, it may be that U.S. research needs to consider foreign research activities for current guidance in our domestic research efforts. Perhaps certain parts of U.S. research should be directed toward foreign markets and world activities.

Businesswise, underdeveloped countries can represent future foreign markets for the U.S. Our ability to work with these countries might be considered an investment for the future which could have richer returns for business and human welfare than any other investment we might make.

In the area of science and foreign policy, it is obvious that rapidly changing technologies here and abroad have a significant impact on U.S. positions relative to foreign affairs. For example, the increased frequency of the introduction of new weapons tends to lower the reliability of information concerning the military capabilities of other countries and, in turn, may cause diplomats and intelligence experts to over- or underestimate foreign power potential. One weapon of today may be more important than a million men with a million weapons 20 years ago, or it may not. Information developed by Johnson and Striner of the Operations Research Office of the John Hopkins University (graph on page), illustrates how the rapid growth in technical choices of the last two decades may be contributing to world instability. One can take no sustainable position in light of this environment.

At all levels, from within a single company to U.S. world affairs, there is a strong need for a measured attack on the problems which relate research to its economic environment. Heretofore, too little effort has been devoted to this area. Instead, there has been a strong tendency to invest in research as a degree of "goodness" without understanding its economic impact. Research can and should be beneficial if properly understood, managed, and controlled. We should not continue to invest in it merely as a matter of fashion or as a "defensive" measure. The industry of discovery needs a science of the future—economics.

All human society throughout history has been influenced by change. The magnitude of the changes and, indeed, the motivation for them, is a problem so large that no individual or institution has been able to muster the skills and capabilities needed to shed light on what brings about change in society. A step in this direction can be taken through development of a rationale for research in its economic environment.



Source: Ellis A. Johnson and Herbert E. Striner, "Research and Development, Resources Allocation, and Economic Growth", Operations Research Office, Johns Hopkins University, July, 1960

Increase in technical choices

Structure and Goal of Quantum Chemistry - II

In concluding his two-part article, the author discusses the approximation methods used in calculating binding energies; the reliability of the wave functions obtained by these methods for calculating other properties of atoms and molecules; and prospects for obtaining more reliable wave functions in the future.

by LAURENS JANSEN

In quantum mechanics, as in classical mechanics, there are relatively few systems of physical interest for which the equations of motion can be solved exactly. In quantum theory, one of the "nonphysical" problems which is capable of exact solution concerns a particle in a box with rigid walls. This case can be treated with very elementary mathematical tools, but it does not represent any situation met in physical reality.

On the other hand, there are very many cases where the fundamental equations can be written down accurately, but in which solutions can be obtained only in approximate form. This does, however, not diminish the significance of the exactly solvable problems. The reason is that the latter are often starting points for approximate calculations; in addition, they provide criteria for the validity of various approximation methods.

APPROXIMATION METHODS

Essentially, two methods of approximation are of general importance in quantum mechanics. Both were developed shortly after the origin of quantum mechanics, although their mathematical bases had been known for some time. The first was Schroedinger's *perturbation theory*, developed in 1926. Compared to the perturbation methods encountered in classical dynamics, the wave mechanical perturbation theory is strikingly simple in its structure. In the perturbation method, an exactly solvable problem is presupposed, from which the actual problem to be solved differs only "slightly"; the difference-Hamiltonian is then considered as a perturbation. If this condition is fulfilled, then the (energy) eigenvalues of the system can be calculated in principle with unlimited accuracy.

The second approximation method is called the *variation(al) method*, developed a few years after the perturbation formalism. The application of variational methods to quantum mechanics grew from the work of Ritz (1909), who considered the solutions of certain differential equations by discussing the equivalent variational problems. The variation method does not presuppose an exactly solvable auxiliary problem. It leads in principle to the exact eigenvalues of Hermitian operators, but in its complete form it is unmanageable for practical applications, since a complete, infinite set of functions is the basis for the exact solutions. If we use so-called "truncated" sets instead of complete sets, then the variation method establishes upper and lower limits for the eigenvalues, of which the upper limits are generally considerably more accurate than the lower ones, and easier to calculate.

As an illustration of problems that can be treated by the two methods, we mention first the *Stark effect*: the problem of an atom in an external electric field. This system is handled effectively by perturbation methods, if we know the energy levels and the wave functions of the atom without field (the unperturbed system) with sufficient accuracy, and if the effect of the electric field is relatively small. In this case the variational method generally gives much poorer results.

A case where the variation method is definitely superior is, for example, that of the helium atom. There is no way in which we can separate this problem into an unperturbed part and a small perturbation, with the condition that the unperturbed problem should be precisely solvable. Consequently, we would have to go to high orders of perturbation theory in order to obtain satisfactorily accurate answers, and higher orders of perturbation theory are forbiddingly difficult to evaluate, except in some "pathological" cases of which the harmonic oscillator is an example.

The impossibility of splitting relevant problems in quantum chemistry into a solvable, unperturbed part and a small perturbation has led to a high preference of variational procedures in quantum chemical applications. These procedures are based on the following consideration: we consider an arbitrary vector, x, in

Hilbert space and form the scalar product (x, Ax), where A is any Hermitian operator. We wish to determine the stationary values of (x, Ax) with respect to variations of x, under the restriction that (x, x) be constant (i.e. we consider only vectors with the same length $\|x\|$). This restriction can be taken into account by means of a Lagrange undetermined multiplier, λ, so that we form

$$\delta[(x, Ax)-\lambda\ (x,x)]=0.$$

The variation gives:

$$(\delta x, Ax)+(x, A\delta x)-\lambda\ (\delta x,x)-\lambda\ (x,\delta x)=0.$$

But the operator A is Hermitian, which means that

$$(x, A\delta x)=(A\delta x,x)^*=(\delta x, Ax)^*.$$

The four terms can now be grouped as follows:

$$(\delta x, (A-\lambda)x)+(\delta x, (A-\lambda)x)^*=0.$$

It is clear that, since this equality must hold for arbitrary δx, it can only be satisfied if

$$(A-\lambda)x=0;\ \text{i.e., if}\ Ax=\lambda x.$$

This means that those vectors x for which (x, Ax) is stationary, must be eigenvectors of A, and that the λ's are the corresponding eigenvalues of A.

The variational principle has strict validity, but in practice it is unmanageable for the direct evaluation of eigenvalues of Hermitian operators. Namely, the condition is that the variation, δx, may be chosen ***completely arbitrarily***. This means that δx must reach all the neighboring vectors of x in Hilbert space. But this implies that δx, and herewith x, must be constructed with the help of a complete (therefore, an infinite) independent set of basis vectors, which condition cannot be realized for practical calculations.

Instead of complete sets, we operate in practice always with truncated sets, i.e., with variation vectors x which are linear combinations of a limited number of independent basis vectors. Again, the stationary values of (x, Ax) are determined, forming $\delta[(x, Ax)-\lambda'(x, x)]=0$, but this time with the truncated set as basis. In this way we determine the stationary values of (x, Ax) with restricted freedom for the variation δx, namely, δx can only reach those vectors in Hilbert space which are formed from linear combinations of the basis vectors of the truncated set. One says: δx can only reach those vectors which lie in the linear manifold spanned by the truncated set. The variational procedure based on this method is called the method of ***linear variation functions*** (also: the Rayleigh-Ritz method). It can easily be shown that, if the truncated set contains ***m*** basis vectors, then the ***m*** stationary values of (x, Ax) are ***upper bounds*** for the ***m*** lowest eigenvalues of A.

Knowledge of upper bounds alone is, however, not very helpful in determining the eigenvalues of Hermitian operators by variational methods. It is therefore of great interest to devise methods establishing criteria also for *lower* bounds for these eigenvalues. Such methods do indeed exist. Until recently, however, they were not nearly as satisfactory as those for upper bounds; in addition, they involve heavy computation. It is important to note that recently some new treatments concerning lower bounds have been developed which show great promise for considerable improvement over the older methods[6].

A typical difficulty associated with conventional perturbation theory may also be mentioned here. Suppose that we wish to determine the ground-state energy (lowest energy eigenvalue) of a system by perturbation methods. The Schroedinger formalism gives explicit series for the eigenvalues, λ_n, and the eigenfunctions, x_n of the Hamiltonian

$$H=H_o+H';$$

$$Hx_n=(H_o+H')x_n=\lambda_n x_n,$$

(H_o is the Hamiltonian of the unperturbed system, H' the perturbation) in terms of the unperturbed eigenvalues, $\lambda_n^{(o)}$, and eigenvectors, $x_n^{(o)}$, and positive powers of matrix elements, $H'_{ij}=(x_i^{(o)}, H'x_j^{(o)})$, of the perturbation Hamiltonian.

If we subscript the ground state by 1, then the first few terms read

$$\lambda_1=\lambda_1^{(o)}+H'_{11}-\sum_{k\neq 1}\frac{H'_{1k}\ H'_{k1}}{\lambda_k^{(o)}-\lambda_1^{(o)}}+\ \ldots\ ;$$

$$x_1=x_1^{(o)}-\sum_{k\neq 1}\frac{H'_{k1}}{\lambda_k^{(o)}-\lambda_1^{(o)}}x_k^{(o)}+\ \ldots\ .$$

We see that, if we include in λ_1 only the term linear in H', then the result will certainly be larger (less negative) than the exact eigenvalue λ_1. This is because $\lambda_1^{(o)}+H'_{11}$ is just the expectation value of $H=H_o+H'$ for the unperturbed state $x_1^{(o)}$:

$$(x_1^{(o)}, (H_o+H')x_1^{(o)})=\lambda_1^{(o)}+H'_{11},$$

and from the variational principle we know that (x_1, Hx_1) is the absolute minimum of the expression (x, Hx), for any x.

But, unfortunately, nothing like this holds for the second and higher approximations! If we include in λ_1 also terms quadratic in H', then the resulting expression is not the expectation value of H for *any* state, and the same is true for the terms of higher

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[6]Report from the International Summer Institute and Symposium in Quantum Chemistry held at Uppsala University, Uppsala, Sweden, July-August 1960 (N. W. Bazley and D. Fox; J. Hersch).

order. Therefore, after the first approximation, we "loose control" of the perturbation results to some extent, in that we do no longer know whether we are above or below the exact eigenvalue in increasing orders of perturbation theory. It even happens that the second-order term in the energy series diverges, in cases where λ_1 itself is finite.

On the other hand, it is possible to modify the conventional perturbation theory in such a way that the resulting series represent, to any order, the exact expectation value of H for some state. They give, therefore, energy-values which are always too high. In addition, it can be proved that the series converge in certain simple cases. Such a series has the characteristic property that the *perturbed* energy eigenvalues occur in the denominators, instead of the unperturbed ones as in the Schroedinger formalism. The series can be obtained by means of a variational method, whereas they are still expansions in powers of H'. Therefore, they are related both to the conventional variation methods and to the perturbation procedure, and are called *variation-perturbation methods*. Since the perturbed energy values occur in the equations in an implicit manner, namely, in the form $\lambda = f(\lambda)$, such equations are usually solved by means of an iterative procedure. For this reason they are also known as perturbation-iteration methods.

The occurrence of the perturbed energy values in "resonance denominators" first appeared in an article by Lennard-Jones (1930). Later, Brillouin (1932, 1933) gave an expression for the infinite perturbation series by an intuitive consideration of the usual scheme. Formally, the first derivation for the series was given by Wigner (1935). Recently, variation-perturbation methods have received increased consideration in quantum chemical calculations.

Reliability of Wave Functions

The structure of quantum chemistry, as described in the preceding sections, is based on a set of classical, analogies, plus a fundamental theorem requiring noncommutability of the dynamical variables. The manipulation process evolves in the framework of the theory of linear transformations on Hilbert space. The complexity of the fundamental equations necessitates the use of approximation methods of which the variational method, by nature of the problems involved in quantum chemistry, has high preference. Together, these aspects determine the limits of what can be reasonably asked of the theory.

The circumstance that, in using the variational method, we are always operating in some sequence of linear manifolds of Hilbert space instead of having "access" to the complete space, imposes very characteristic properties on the approximate solutions obtained. Suppose that we are calculating the ground-state energy, $\lambda^{(1)}$ (we will now use superscripts to index the different eigenvalues, to avoid confusion with the subscript-index for the trial vectors), of some molecular system. Let $x_1, x_2, x_3, \ldots$ be a sequence of trial vectors, obtained by minimizing the scalar product (x, Hx), where H is the Hamiltonian of the system, with respect to variations (δx) in the linear manifolds of dimensions $m, m+1, m+2, \ldots$, respectively. Then we know, from the variational principle, that

$$(x_1, Hx_1) \geqslant (x_2, Hx_2) \geqslant (x_3, Hx_3) \geqslant \ldots, \geqslant \lambda^{(1)}.$$

Thus, it is certain that, if we would only continue the process of ever enlarging the initial manifold of Hilbert space until it spans the complete space, we would reach precisely the exact eigenvalue, from whatever linear manifold we started. But this is impossible in practice, so that the process must be terminated after a finite number of steps. If the initial manifold is chosen while exercising good "physical sense", then the final value for the energy will be close to $\lambda^{(1)}$.

A crucial problem concerns the accuracy with which *different* quantities (other than the energy) characteristic for the system, which we like to know, such as the electric dipole moment, electron charge distribution, polarizability, and the like, are approximated in the limiting process. Since the variational method is, in this case, "tailored" to fit the energy, it is not certain beforehand that (x_{n+1}, Ax_{n+1}) will be closer to the true expectation value, $(x^{(1)}, Ax^{(1)})$, than (x_n, Ax_n) or any previous expectation value for the sequence $x_1, x_2, \ldots, x_n, x_{n+1}, \ldots$. A is here a different Hermitian operator, and $x^{(1)}$ is the exact eigenvector belonging to $\lambda^{(1)}$. Inversely, we could have followed a variational procedure for A, and then we are uncertain about the energy expectation values themselves. This situation applies even if $x^{(1)}$ is an eigenvector of both Hermitian operators considered, *or if the two operators commute.* This difficult problem has recently attracted increased attention [7, 8, 9].

Some insight is already gained if we determine the relation between the trial energy, (x_n, Hx_n), say, and the distance in Hilbert space between the trial vector x_n, and the eigenvector $x^{(1)}$, belonging to the exact lowest eigenvalue, $\lambda^{(1)}$. Such a relation is given by the *Eckart criterion* (1930):

$$\|x_n - x^{(1)}\|^2 \leqslant \frac{(x_n, Hx_n) - \lambda^{(1)}}{\lambda^{(2)} - \lambda^{(1)}}$$

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[7] cf. P. O. Löwdin, *Ann. Revs. Phys. Chem. 11*, 107 (1960);
[8] V. M. Buimistrov, *J. Exptl. Theoret. Phys.* (USSR) *35*, 1161 (1958);
[9] H. F. Weinberger, "Error bounds in the Rayleigh-Ritz approximation of eigenvectors" (preliminary manuscript).

$\lambda^{(2)}$ is the energy eigenvalue for the first excited state of the system. This criterion establishes an upper limit for $||x_n - x^{(1)}||$.

Thus, we know that the upper limits of the distances $||x_1 - x^{(1)}||$, $||x_2 - x^{(1)}||$, . . . , will decrease, in this order, with $(x_n, Hx_n) \to \lambda^{(1)}$ as $n \to \infty$. These upper limits will describe some curve on the surface of the unit hypersphere in Hilbert space; the shape of the curve depends on the choice of the infinite sequence $x_1, x_2, \ldots$. The problem is now to determine how the trial expectation values (x_1, Ax_1), (x_2, Ax_2), . . . of any other Hermitian operator A will change as we move along such a curve on the surface of the hypersphere.

Before continuing, we make a distinction between ***bounded*** and ***unbounded*** operators. An operator (linear transformation) B on Hilbert space is bounded if there exists a positive finite constant, K_B, such that, for any vector x, $||Bx|| \leqslant K_B||x||$. The smallest possible K_B with this property is called the ***bound*** of B. If such a constant does not exist, then the operator is called unbounded. For bounded operators we know that all trial expectation values (x_n, Bx_n), with any value of n, will be finite, since, according to the Schwarz inequality:

$$|(x, By)| \leqslant ||x||\ ||By||,$$

for any two vectors x, y, and thus, for unit vectors x_n,

$$|(x_n, Bx_n)| \leqslant ||x_n||\ ||Bx_n|| = ||Bx_n|| \leqslant K_B.$$

Note that, since B is Hermitian, (x_n, Bx_n) is real. On this general basis we can, however, not find out more details concerning the trial expectation values of B. The answer must be obtained from a more profound topological analysis.

To proceed a little further, we restate the problem in the following, more general, form. Let A be a Hermitian operator with eigenvalues $\lambda^{(1)} \leqslant \lambda^{(2)} \leqslant \ldots \leqslant \lambda^{(n)} \leqslant \ldots$, and orthonormal eigenvectors $x^{(1)}, x^{(2)}, \ldots, x^{(n)} \ldots$. We carry out a variational procedure for the lowest eigenvalue, $\lambda^{(1)}$, of A, by minimizing the scalar products (x_n, Ax_n), where $x_n \in M_n$, for $n = 1, 2$. (the symbol $\in$ denotes that the vector x_n is contained in M_n). The linear manifold M_n is one of a sequence $M_1 \subset M_2 \subset \ldots \subset M_n \ldots$ of manifolds of Hilbert space (the symbol $\subset$ indicates that the set to the left is contained in the set to the right of $\subset$).

Consider now another Hermitian operator, B, for which $x^{(1)}$ is in general not an eigenvector. While the sequence of stationary values (x_n, Ax_n) is known to approach $\lambda^{(1)}$ monotonically, and from above, no equivalent theorem holds for the expectation values (x_n, Bx_n) of B relative to the exact value $(x^{(1)}, Bx^{(1)})$. To estimate the error $|(x_n, Bx_n) - (x^{(1)}, Bx^{(1)})|$, we consider the scalar product

$$(x_n \pm x,\ B(x_n \mp x)) = (x_n, Bx_n) - (x, Bx) \mp 2\mathrm{Im}\ (x_n, Bx),$$

for any trial vector x_n and any vector x in Hilbert space. Since (x_n, Bx_n) and (x, Bx) are real, if follows that

$$(x_n, Bx_n) - (x, Bx) = \mathrm{Re}\ (x_n \pm x,\ B(x_n \mp x)),$$

and, by the Schwarz inequality,

$$|(x_n, Bx_n) - (x, Bx)| \leqslant |(x_n \pm x,\ B(x_n \mp x)|| \leqslant ||x_n \pm x||\ ||B(x_n \mp x)||.$$

This inequality, is, however, of little use, since we do not possess knowledge concerning $||x_n \pm x||$ and $||B(x_n \mp x)||$, if x stands for the exact eigenvector of A, $x^{(1)}$, in our problem. In order to proceed still further, we have to establish upper limits, again this time for the two quantities above. This can be done in several different ways:

1) First, we consider $||x_n + x||\ ||B(x_n - x)||$. As far as $||x_n + x||$ is concerned, an upper limit is 2, according to the triangle inequality:

$$||x_n + x|| \leqslant ||x_n|| + ||x|| = 2\ .$$

We now have:

$$|(x_n, Bx_n) - (x, Bx)| \leqslant 2||B(x_n - x)|| \leqslant 2||B(x_n - x)||_{\max},$$

where the subscript "max" implies that we determine the maximum of $||B(x_n - x)||$ under the subsidiary condition $||x_n - x|| = \text{constant}$. One upper bound is, of course, given by

$$||B(x_n - x)||_{\max} \leqslant K_B||x_n - x||.$$

Although we do not know $||x_n - x||$, we do know its upper bound, from the Eckart criterion applied to operator A. This, then, finally gives an upper bound for the error in the expectation value for B:

$$|(x_n, Bx_n) - (x^{(1)}, Bx^{(1)})| \leqslant 2K_B||x_n - x^{(1)}||_{\max} = 2K_B\left[\frac{(x_n, Ax_n) - \lambda^{(1)}}{\lambda^{(2)} - \lambda^{(1)}}\right]^{1/2}.$$

The result shows again that the error remains finite if B is bounded; further, that the error decreases linearly with decreasing $||x_n - x^{(1)}||$. However, we do no longer know whether we approach the exact expectation value $(x^{(1)}, Bx^{(1)})$ monotonically, and whether this approach is from above.

2) An upper bound for the error in the expectation value of B can also be obtained in the following manner. We start again from the equation

$$|(x_n, Bx_n) - (x, Bx)| \leqslant ||x_n \pm x||\ ||B(x_n \mp x)||.$$

If we replace the operator B by B-a, where a is any scalar quantity, then nothing changes on the left-hand side of the inequality. Therefore, we can write

$$|(x_n, Bx_n) - (x, Bx)| \leqslant ||x_n \pm x||\ ||(B - a)\ (x_n \mp x)||,$$

and we choose a such that it minimizes (B-a)$(x_n \mp x)$.

By taking the square of this quantity, and multiplying out, we have

$$\|(B-a)\,(x_n \mp x)\|^2 = \|B(x_n \mp x)\|^2 + a^2\|x_n \mp x\|^2 - 2a(x_n \mp x,\ B(x_n \mp x)),$$

which expression is a minimum, with respect to variation of a, if

$$a = \frac{(x_n \mp x,\ B(x_n \mp x))}{\|x_n \mp x\|^2},$$

and goes over into

$$\|B(x_n \mp x)\|^2 - \frac{((x_n \mp x)\ B(x_n \mp x))^2}{\|x_n \mp x\|^2} \equiv (\Delta B)^2_{x_n \mp x}\|x_n \mp x\|^2,$$

where $(\Delta B)^2_y$ is called the *width* of B at y. Our inequality now reads[8]

$$|(x_n,\ Bx_n) - (x,\ Bx)| \leqslant \|x_n \pm x\|\ \|x_n \mp x\|\{(\Delta B)^2\}^{\frac{1}{2}}/$$

lower value for $x_n + x$ or $x_n - x$.

The difficulty with this inequality, as it stands, is that its right-hand side cannot be computed without explicit knowledge concerning the exact eigenvalue x. To proceed, we again have to satisfy ourselves with less accuracy and replace different members by upper bounds[10]:

$\|x_n + x\| \to 2$; $\|x_n - x\| \to \|x_n - x\|_{max}$, and we estimate an upper bound for $(\Delta B)^2_{x_n - x,}$ for given $\|x_n - x\|$.

The situation is still more critical with respect to the unbounded operators. Consider such an unbounded operator, D, and the infinite sequence of trial vectors $x_1, x_2, \ldots, x_m, x_n, \ldots$. The fact that this sequence converges, in the norm ("length"), towards x is expressed by

$$\left.\begin{aligned}\|x_n - x_m\| &\to 0\\ \|x - x_n\| &\to 0\end{aligned}\right\} \text{ as } n, m \to \infty;$$

and that the stationary values $(x_n,\ Ax_n)$ converge towards the exact eigenvalue, $\lambda^{(1)}$, of A, by

$$(x_n,\ Ax_n) - \lambda^{(1)} \to 0 \quad \text{as } n \to \infty.$$

However, if D is not bounded relative to the usual norm-topology, then it often occurs that

$$(x_n,\ Dx_n) - (x,\ Dx) \not\to 0 \quad \text{as } n \to \infty;$$

its limit can in principle attain any value.

There are several unbounded operators of interest in molecular problems; for example, the dipole moment operator (those of higher electric multipole moments are unbounded as well). Thus, from an excellent trial value for the energy of a molecular system, we cannot generally draw conclusions concerning the trial expectation values of the dipole moment, etc. The reason for this lies in the nature of the limiting procedure and in the topological properties of Hilbert space.

Further Development of the Theory

The second phase in the development of quantum chemistry also saw the beginning of high-speed electronic computing as applied to the accurate determination of atomic and molecular structures. Several of such fast electronic computers are now utilized by quantum chemists throughout the world. Through such facilities it was possible for Pekeris (1959) to obtain a very precise answer for the ground-state energy of the helium atom. He used a wave function containing 1078 terms to reach his fabulous accuracy.

With Pekeris' achievement, the second phase in the development of quantum chemistry is coming to a close. To summarize, the results of this stage were an extraordinary fertility of qualitative or semiempirical conclusions. From a standpoint of the basic theory however, such results possess a highly approximate character. Attempts to render the conclusions more precise led to the discovery of some curious properties of the approximate treatments. One of these was, as we have already mentioned, the fact that an excellent value for the energy of an atomic or a molecular system may be obtained by means of a "bad" wave function. The wave function is "bad" in that it leads to wrong predictions concerning other properties of the same system. Also, semiempirical treatments which give relatively good agreement with experiment, often become less satisfactory after attempts to improve upon them from a standpoint of basic theory.

Finally, the great number of empirical relationships between different sets of phenomena, assembled especially in chemistry during many years of research, will have to find a better theoretical explanation. So far, the fundamental theory is apparently often too "fine-grained" to explain these "coarse-grained" empirical correlations.

It is becoming apparent that the solution to such difficulties must not be sought solely in the development of electronic computers of ever increasing speed. As G. G. Hall[11] has emphasized, it may be very hard, even with a rapid technical development of the electronic computers, to reach systems of some degree of complexity in a chemical sense. The typical difficulties have, instead, to be resolved first of all by a deep-going analysis of the mathematical foundations of the methods, since they are associated with topological peculiarities of Hilbert space It may then also become clearer how, on such a basis, the gap between the semiempirical and basic theories can be bridged and understood.

[10] W. Brandt and L. Jansen, (in preparation).

[11] G. G. Hall, *Rep. Progr. Phys. 22*, 1 (1959).

Writings by STAFF Members

Design Informaton on Titanium Alloys for Aircraft and Missiles. Design allowables are summarized for the commercially important titanium alloys. Information on the all-beta Ti-13V-11Cr-3Al alloy is not yet complete, and little design information is yet available on the super alphas. ***W. P. Achbach and R. J. Favor.*** PB 151104; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Report No. 145*, Jan. 10, 1961, 87 pp. (OTS $2.25)

Application of Electron-Probe Microanalysis to Interface Segregation. Determination of concentrations at phase and grain boundaries requires geometrical correction for the finite size of the irradiation region. At an abrupt phase boundary, the maximum gradient is limited by the finite diameter of the electron probe. This concentration gradient has been calculated, assuming a uniform circular probe, and compared with that measured for an undiffused interface. This limiting case is used to correct measured concentrations at actual phase boundaries. Applications of problems of segregation in meteorites and other alloys, and to concentration gradients across diffusion interfaces are described. ***A. E. Austin, N. A. Richard, and C. M. Schwartz.*** Paper from *Proceedings, Stockholm X-Ray Symposium*, Elsevier Publishing Co., Princeton, New Jersey. April, 1961, pp. 401-406.

Investigations of Rare-Earth Oxide Cathodes. The emission properties of a mixture of the oxides of neodymium and gadolinium coated on a tantalum wire were determined. The emission level at 1400 C was as high as 0.5 amp/cm^2 but, in common with cathodes composed of the same coating on other refractory-metal base wires, the emission tended to be unstable at brightness temperatures of about 1300 C and below. ***J. B. Baker and G. B. Gaines.*** PB 153823; U.S. Air Force, Cambridge Research Laboratories, *AFCRL-TN-60-1152*, Nov. 1, 1960, 11 pp. (LC mi $2.40, ph $3.30)

Investigations of Rare-Earth-Oxide Cathodes. High thermionic-emission levels were obtained from gadolinium oxide and from a mixture of 75 Nd_2O_3 - 25 Gd_2O_3, but special activating procedures were required to accomplish this. The emission properties of the oxide mixtures differed for various refractory-metal bases with the highest emission currents being obtained with tantalum bases. The presence of carbon in the coating of a cathode composed of the 75 Nd_2O_3 - 25 Gd_2O_3 mixture resulted in higher activation than was obtained without the carbon. Gadolinium oxide gives higher emission than thorium oxide in the temperature range of 1200 to 1500. ***J. B. Baker and G. B. Gaines.*** AD 255304; U.S. Air Force, Cambridge Research Laboratories, *AFCRL-183*, March, 1961, 24 pp. (OTS $2.60)

Review of Recent Developments in the Technology of Tungsten. Surveys fabrication, properties, structures, and applications. ***V. D. Barth.*** PB 171627; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Memorandum 108*, May 18, 1961, 6 pp. (OTS $0.50)

Stress Corrosion Cracking. Discusses causes and avoidance of failures from corrosion cracking in light and other metals. ***Warren E. Berry.*** *Light Metal Age*, v. 19, June, 1961, pp. 6-10.

Summary of Present Information on Impact Sensitivity of Titanium When Exposed to Various Oxidizers. Summarizes the present status of the compatibility of titanium with LOX (liquid oxygen) and with other oxidizers such as N_2O_4, F_2, and ClF_3. Considerable experimental evidence has been obtained which indicates that, under certain conditions of impact, titanium and its alloys may ignite in strong oxidizers of the type used in rocket and missile propulsion systems. However, only in the case of LOX does there appear to be danger that the reaction will propagate and completely consume the titanium. ***W. K. Boyd.*** PB 161239; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Memorandum 89*, March 6, 1961, 9 pp. (OTS $0.50)

Metallographic Preparation of Selected Ceramic Materials. Gives procedures for mounting, grinding, and polishing specimens of graphite or carbon, uranium and thorium carbides, uranium silicide and dioxide, alumina, beryllia, and mixtures of hard particles in soft matrices such as oxide or carbide fuel particles in a graphite matrix. ***Charles H. Brady, Richard D. Buchheit, and Arnold F. Gerds.*** U.S. Atomic Energy Commission, *TID-5912*, May 1960, 13 pp. (LC mi $2.40, ph $3.30)

Studies, Research, and Investigations on Compounds Formed From Elements of Groups II and VI of the Periodic Table. The studies begun on HgSe during the previous contract have been continued. The best materials prepared have carrier densities at room temperature on the order of 10^{17} cm^{-3}. A sound ingot produced from vapor deposition of HgSe is comparable in quality to ingots prepared by the Bridgman method. Studies on the HgTe-Cd-Te alloy system reveal that a material of nominal composition 90HgTe-10CdTe has a transmission edge within the 8 to 14-micron-wavelength region. Hall measurements at low temperature show that the low-cadmium-content alloys made thus far are p-type, having a hole-to-electron mobility ratio from 0.035 to 0.01. ***C. M. Chapman, B. Paris, et al.*** PB 153923; U.S. Army Research and Development Laboratory, Oct. 31, 1959, 37 pp. (LC mi $3.00, ph. $6.30)

The Mechanism of Pressure Bonding. The pressure bonding of OFHC copper was studied, and the mechanism of the solid-phase bonding of two components under the application of heat and pressure was established. The effects of pressure, temperature, grain size, and surface roughness were evaluated. ***George W. Cunningham and Joseph W. Spretnak.*** U.S. Atomic Energy Commission, *BMI-1512*, April 6, 1961, 115 pp. (OTS $2.25)

Reactor Core Materials. A review of recent developments in the fields of fuel and fertile materials, moderator materials, nuclear poisons, cladding and structural materials, and special fabrication techniques. ***R. W. Dayton, E. M. Simmons, R. W. Endebrock, et al.*** U.S. Atomic Energy Commission, *Reactor Core Materials*, v. 4, no. 2, May, 1961, 64 pp. (U.S. Government Printing Office $0.55)

Progress Relating to Civilian Applications During April, 1961. Gives status of work at Battelle on nuclear reactor materials and components, fuels, radioisotope and radiation applications, and recovery of spent fuel elements. ***Russell W. Dayton and Clyde R. Tipton, Jr.,*** U.S. Atomic Energy Commission, *BMI-1514*, May 1, 1961, Sections individually paged. (OTS $2.00)

HOW TO GET COPIES OF STAFF WRITINGS

In this section are listed reports, articles, and other writings authored by Battelle staff members that have recently become generally available. • *Reports, unless otherwise indicated, can be purchased prepaid directly from the Office of Technical Services, U.S. Department of Commerce (designated OTS), Washington 25, D. C. or from the Publication Board, Library of Congress (designated LC), Washington 25, D. C. Abbreviation "mi" stands for microfilm, "ph" for photostat. The PB and AD numbers or, in the case of the U.S. Atomic Energy Commission Reports, the AEC numbers of each report must be listed with the order.* • *Federal agencies and government contractors, their subcontractors and suppliers may obtain DMIC Reports gratis from the Defense Metals Information Center, 505 King Avenue, Columbus 1, Ohio.* • *In most cases, copies of articles and papers listed in this section—but not in the Abstracts Section which follows—are available gratis from the Battelle Publications Office, 505 King Avenue, Columbus 1, Ohio.*

Development of Container Materials for Lampre Applications. Some 83 high-purity binary tantalum-base alloys were prepared as candidate materials of construction for the Los Alamos Molten Plutonium Reactor Experiment (LAMPRE). The alloys were evaluated metallurgically at Battelle. Preliminary data indicate that good resistance to attack by the fuels can be obtained by alloying tantalum. Alloys containing additions of rhenium and tungsten have shown good corrosion resistance in polythermal (1382 to 1022 F)-tilting-furnace exposures. ***David C. Drennen, Merritt E. Langston, Charles J. Slunder, Joseph G. Dunleavy, and A. M. Hall.*** U.S. Atomic Energy Commission, *BMI-150,* Feb. 14, 1961, 46 pp. (OTS $1.25)

Effects of Irradiation Upon Hafnium Diboride. Natural hafnium diboride and hafnium diboride 55% enriched in boron-10 were irradiated in two capsules in the ETR to boron-10 burnups of about 25 to 50% at temperatures from 400 to 600 F. Major structural damage was revealed by X-ray diffraction examination, both diborides degrading to amorphous structures. Attempts to measure helium retention were unsuccessful. On the basis of the results obtained with the two capsules, neither the natural nor the enriched compound seems to offer much promise for control-rod applications. ***Robert A. Ewing and Duane N. Sunderman.*** U.S. Atomic Energy Commission, *BMI-1521,* June 14, 1961, 7 pp. (OTS $0.50)

Boiling-Water Void Distribution and Slip Ratio In Heated Channels. Distribution of void and the behavior of slip ratio in light water in a rectangular heated test section were investigated using a beta-particle-attenuation technique in support of the joint U.S.-Euratom program on development of economic nuclear power systems. The amount of void in the subcooled region was determined to within ±3% void. The slip ratio at a high Reynolds number is much more a function of the Reynolds number than of pressure. Furthermore, for Reynolds numbers between 50,000 and 90,000, the slip ratio at constant void fraction reaches a maximum. ***James J. Foglia, Friedrich G. Peter, Harold M. Epstein, Roger O. Wooton, David A. Dingee, and Joel W. Chastain.*** U.S. Atomic Commission, *BMI-1517,* May 31, 34 pp. (OTS $1.00)

The Reduction of Carbon Dioxide to Carbon and Water in the Process for Regeneration of Breathing Oxygen From Exhaled Carbon Dioxide. Describes an experimental study of the catalyzed conversion of carbon dioxide to water and carbon by reduction with hydrogen. The reduction is one of the steps in a three-step process for recovering breathable oxygen from exhaled carbon dioxide in manned vehicles on space missions of up to three years' duration. ***J. F. Foster and J. S. McNulty.*** Paper from *Institute of Environmental Sciences,* Proceedings, Institute of Environmental Sciences, 1961, 13 pp.

Expensive or Economical? Suggestions for Rational Use of Transport Concrete. Use of truck-mounted concrete mixers along with prefabricated structural parts results in acceleration of building operations, economy of personnel, decrease of building costs and increase in quality. Efficient operation requires close collaboration between builders and transporters (*In German*) Teuer oder wirtschaftlich° Hinweise fur eine rationelle Verwendung von Transportbeton. ***Bruno Hake.*** *Die Bauwirtschaft,* v. 15, no. 24, 1961, pp. 1-4.

Irradiation-Capsule Study for SM-2 Reference and Alternate Dispersion Fuels. Nominal 24 to 40 w/o highly enriched UO_2 dispersed in a matrix of Type 347 stainless steel, with burnable poisons in the form of B_4C, ZrB_2, NbB_2, or boron-10, and clad with Type 347 stainless steel are being evaluated for the SM-2 by capsule irradiation in high-flux positions at the MTR and the ETR. Irradiations of four capsules were completed early in 1960; maximum specimen burnups were approximately 40% of the total uranium atoms originally present. Temperature data from six current in-pile capsules indicate that the majority of the specimens now being irradiated are close to design temperature. Estimates of current burnup levels include consideration of specific uncertainties involved in the calculations and the measured burnup of specimens from the first capsules. ***David B. Hamilton, John F. Lagedrost, Eugene M. Simons, and John H. Stang,*** U.S. Atomic Energy Commission, *BMI-1516,* May 25, 1961, 30 pp. + appendixes. (OTS $1.25)

Superalloy Forgings. Deals with several forgeable nickel-base, iron-base, and cobalt-base alloys that have useful service temperatures in the range of 1200 to 1800 F. It does not cover the more widely used alloys, such as A-286 or Inco 901, but is limited to the newer alloys that have higher useful service-temperature ranges. The review is intended to provide useful data on sizes, shapes, and mechanical properties of super-alloy forgings. ***H. J. Henning and F. W. Boulger.*** BP 161236; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Memorandum 86,* Feb. 10, 1961, 41 pp. (OTS $0.50)

Review of Recent Developments in the Metallurgy of Beryllium. Surveys published data on purification and mechanical and physical properties. ***Webster Hodge.*** PB 171624; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Memorandum 105,* May 10, 1961, 6 pp. (OTS 0.05)

Evolution of Ultrahigh-Strength, Hardenable Steels for Solid-Propellant Rocket-Motor Cases. Discusses the evolution of the current roster of special steels and shows their relationship to the older, more familiar steels. The evolution is traced from AISI 4130, through AISI 4340 and its modifications, and includes the 5 Cr-Mo-V steels (hot-work die steels). The discussion covers the influence of composition of performance and properties, response to tempering and the effects of tempering, and the differences and similarities among the steels. Also included are comments on such matters as fabrication, welding, heat treating, notch sensitivity, decarburization, high-temperature properties, and the benefits of vacuum melting. ***H. J. Hucek, A. R. Elsea, and A. M. Hall.*** PB 171423; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Report No. 154,* May 25, 1961, 42 pp. (OTS)

Notch Sensitivity of Refractory Metals. The tensile and notch-tensile properties of four refractory metals (Mo, W, Nb, and Ta) and one alloy (Mo-O.5Ti) were investigated. All the materials were evaluated in bar form, and the Mo and Mo-O.5Ti also were studied in sheet form. The notch sensitivity of each material was evaluated on the basis of several criteria, including the notch-unnotch strength ratio, the ductility transition, and the fracture transitions. The following conclusions were made from an analysis of the data: the temperature at which the notch-unnotch strength ratio decreases rapidly is an adequate criterion for notch sensitivity; the transition from a shear to a cleavage fracture mechanism generally occurs at a higher temperature than does the ductility transition; the materials investigated tend to become notch sensitive at a higher temperature in the recrystallized condition than in the wrought stress-relieved condition; the materials investigated, listed in order of decreasing temperature at which they become notch sensitive are — W, Mo bar, Mo Sheet, Mo-O.5Ti bar, Mo-O.5Ti sheet, Nb, and Ta. ***A. G. Imgram, F. C. Holden, H. R. Ogden, and R. I. Jaffee.*** American Institute of Mining, Metallurgical, and Petroleum Engineers, *Transactions, Metallurgical Society,* v. 221, no. 3, June, 1961, pp. 517-527.

Predicting Burnup of Stainless-UO_2 Cermet Fuels. Although it requires enriched U, ss-UO_2 fuel serves well and is predictable in compact power reactors. Fabricators can improve the burnup performance by controlling UO_2 particle "stringering" and other structural defects that cause cracks and blisters. Pressure bonding, slip casting, cold extrusion, and powder rolling or combinations of these cause less UO_2 stringering than does rolling because they involve less metal flow during fabrication. These processes will assume more important roles in future fabrication of ss-UO_2 disperson fuel elements if they do indeed improve irradiation life. ***Donald L. Keller.*** *Nucleonics,* v. 19, June 1961, pp. 45-48.

Review of Recent Developments on Oxidation-Resistant Coatings for Refractory Metals. Reviews recent developments in oxidation-resistant protective coatings for the four refractory metals, Cb, Ta, Mo, and W. ***W. D. Klopp.*** PB 171621; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Memorandum 102,* April 26, 1961, 3 pp. (OTS $1.10)

Dosimetry Techniques for Environmental Testing. As yet no one dosimeter has the desirable characteristics for use in measuring a broad range of exposures. Systems presently available for gamma measurements are most useful for integrated exposures up to 10^7 rads. For neutrons, foil techniques or rate devices such as ion chambers calibrated against foils, show the most promise for solving these measurement problems. ***J. F. Kircher and Mary J. Oestmann.*** Paper from *Institute of Environmental Sciences, Proceedings, Annual Technical Meeting,* Institute of Environmental Sciences, Mt. Prospect, Illinois, 1959, pp. 150-155.

The Effect of Hydrogen on the Mechanical Properties of Titanium and Titanium Alloys. Results are given on the effect of notches, testing speed, and testing temperature on hydrogen embrittlement of high-purity titanium, commercial purity titanium (A-55), and the commercial 8% manganese alloy (C-11OM). The effect of hydrogen on the microstructure and mechanical properties of alpha-beta titanium-molybdenum alloys is presented. Hydrogen pickup of A-55 and C-11OM titanium alloys in sodium hydride and Virgo descaling and acid pickling was also investigated. The removal of hydrogen by vacuum annealing of A-55 and C-11OM titanium was studied. ***G. A. Lenning, C. M. Craighead, and R. I. Jaffee.*** PB 154749; U.S. Army, Watertown Arsenal Laboratories, *WAL 401/79-31,* July 31, 1954, 99 pp. (LC mi $5.40, ph. $15.30)

The Development of Radioactive-Tracer Quality-Control Systems. Development of radiometric analytical methods for use in quality control in the manufacture of portland cement is described. Rapid procedures for the determination of Mg, Ca, Fe, and sulfate were developed. ***Robert Lieberman, Charles W. Townley, Charles T. Brown, James E. Howes, Jr., Robert A. Ewing, and Duane N. Sunderman.*** U.S. Atomic Energy Commission, *BMI-1508,* March 27, 1961, 26 pp. (OTS $0.75)

Rocket Nozzle Environment Tests on an SiC Ceramic. Nozzle liners of a silicon-carbide ceramic were evaluated under various firing conditions in a laboratory-scale rocket motor burning gaseous hydrogen and oxygen. Data from tests using large liquid-propellant motors showed a similar effect on service life of this material. As the failure mechanism appeared to be the same, it was concluded that the laboratory motor may provide a means to obtain engineering estimates of the service life of practical rocket nozzles. ***James F. Lynch, Edward E. Ungar, and Winston H. Duckworth.*** *American Ceramic Society Bulletin,* v. 40, July, 1961, pp. 445-449.

The Factors Influencing the Fracture Characteristics of High-Strength Steel. Service failures of structures made from high-strength steel are frequently by fracture rather than by excessive yielding. Hence, factors influencing fracture behavior take on increased significance as strength levels are raised. The factors, both external and metallurgical, influencing the ductile-brittle transition of high-strength steels are discussed. ***C. W. Marshall.*** PB 151106; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Report No. 147,* Feb. 6, 1961, 40 pp. (OT $1.25)

Metallurgical Research and Development in Electron Devices. Columbium, hafnium, and binary alloys based on both metals, were fabricated to fine wires and evaluated to determine their applicability for use in electron tubes. Alloying both metals resulted in considerably improving their strengths, at temperatures through 1000 C. Of the alloys investigated, a columbium-0.65% zirconium alloy and hafnium alloys containing 2.5 and 5% columbium showed optimum combinations of workability, strength, and ductility in these respective alloy bases. These alloys show considerable promise for use as grid and/or structural components operating at elevated temperatures. ***D. J. Maykuth, G. S. Root, et al.*** PB 155739; U.S. Army Signal Corps, AD-237297, June, 1961, 109 pp. (OTS $9.10)

Statistical Analysis of Tensile Properties of Heat-Treated Mo-0.5Ti Sheet. Direction of testing affects all five tensile properties; ultimate and yield strength are higher in the transverse direction, while elongation is higher in the longitudinal direction. Gage has little effect on ultimate or yield strength, but an increase in gage causes a pronounced increase in elongation. Direction of testing does not interact with gage effect, the effect of gage on all five tensile properties is about the same in both the longitudinal and transverse directions. ***H. R. Ogden and G. H. Beatty.*** PB 161251; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Memorandum 101,* April 24, 1961, 18 pp. (OTS $2.60)

Fabrication of Compartmented Flat-Plate Ceramic Fuel Element. Satisfactory Zircaloy-clad flat-plate compartmented UO_2 fuel elements were produced up to 4 x 40 in. incorporating approximately 350 individual fuel compartments. The size of the plate was limited by available equipment. The plates have performed satisfactorily in Bettis capsule and loop testing, in defected and undefected corrosion tests, in mechanical tests, and metallographic tests. ***S. J. Paprocki, E. S. Hodge, P. J. Gripshover, and D. C. Carmichael.*** Paper from *Proceedings of the Fuel Element Fabrication Symposium, Vienna, Austria,* Academic Press, London, England. 1961, pp. 283-300.

Brazing for High-Temperature Service. Summarizes many of the important developments in brazing for service temperatures in excess of 600 F. Heating methods, filler metals, atmospheres, fluxes, and deoxidizing agents are discussed as they affect the brazing of heat-resistant metals and alloys. Some attention is given to specific brazing applications. ***H. E. Pattee and R. M. Evans.*** PB 151108; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Report No. 149,* Feb. 21, 1961, 32 pp. (OTS $1.00)

ML-1-1B Critical-Assembly Studies. Critical-assembly studies were conducted to provide physics and engineering data to aid Aerojet-General Nucleonics in the development of the Mobile Low Power Reactor (ML-1-1B). The ML-1-1B core without steel-shim poison was critical with 48 elements containing 31,088.36 g of uranium-235, with an excess reactivity of 0.746 x 10^{-2} Δ k/k at a moderator temperature of 23.00 C. The core with the steel-shim poison was critical with 51 elements containing 32,999.97 g of uranium-235, with an excess reactivity of 0.418 x 10^{-2} Δ k/k at a moderator temperature of 23.00 C. ***Joseph W. Ray, Richard G. Matthews, William S. Hogan, David A. Dingee, and Joel W. Chastain, Jr.*** U.S. Atomic Energy Commission. *BMI-1501,* Feb. 21, 1961, 77 pp. (OTS $2.00)

Numerical Solution of Reactor Stress Problems. Generalized computer codes were devised for solving stress problems of some complexity. These codes were applied to stress problems relating to the graphite moderator elements in the Experimental Gas-Cooled Reactor. The stress relief obtained by subdividing the moderator elements was evaluated. The distortion and bending moments of the elements were also determined. ***Robert F. Redmond, Lewis E. Hulbert, and Richard W. Clark,*** U.S. Atomic Energy Commission, *BMI-1503,* Feb. 28, 1961, 30 pp. + appendixes. (OTS $1.50)

Development of Improved Methods for Cold Extrusion of Titanium. The applicability was investigated of the cold-extrusion process for producing shapes of commercially pure and alloyed Ti that simulate parts used in engine and aircraft construction. Studies of die design, surface coatings, and lubricants, in which 1½-in.-diameter billets of unalloyed Ti were forward-extruded with a 60% reduction to bars 0.95-in. diameter, led to the development of techniques for producing extruded shapes with surface finished of 30 to 60μ in. ***A. M. Sabroff, et al.*** PB 155150; U.S. Air Force, Air Material Command, Oct. 11, 1957, 96 pp. (LC mi $5.40, ph $15.30)

The Emittance of Coated Materials Suitable for Elevated-Temperature Use. Compiles original test data taken from the literature published during the period 1940 to 1949, inclusive, and from as much of the 1960 literature as could be obtained. Covers boride, carbide, oxide, and silicide coatings and enamels and paints. ***W. D. Wood, H. W. Deem, and C. F. Lucks.*** PB 171622; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Memorandum 103,* May 4, 1961, 138 pp. (OTS $0.50)

BATTELLE TECHNICAL REVIEW

ABSTRACTS

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Our new format should help you scan the page quickly. Boldface clue words identify subject matter. Titles appear unchanged at the beginning of each abstract.

ADMINISTRATION AND PHILOSOPHY OF RESEARCH

Engineering Organization for a Large Air Force Communication System — The **engineering organization** which was set up by a contractors' team to design a major **Air Force Communication System,** and some aspects of the first year's operation. — Rodney D. Chipp. *IRE Transactions on Engineering Management,* v. EM-8, no. 2, June 1961, p. 86-92. (TK1 In6.6em Vis.)

* Planning for Research in **Management Control Systems**--A Suggested Model — A mathematical model has been formulated as a vehicle for conducting **research.** This model is unique in two ways: in its identification of decision making activity and in its picture of business activity as a queueing network. — Jay B. Heyne. *Journal of Industrial Engineering,* v. 12, no. 4, July-Aug. 1961, p. 253-263.

Project Planning — Explains how to lay a firm foundation for **project planning.** — E. Raymond Brooke. *Machine Design,* v. 33, Aug. 3, 1961, p. 76-80.

Decentralization--New Road to **Creativity** — Concludes that situations must be planned in which persons can rise as far as their abilities will take them. — Merritt A. Williamson. *Research/Development,* v. 12, Aug. 1961, p. 16 + 7 pages.

Economics of **Industrial Research** Development — Reviews R & D expansion over the last decade and predicts its **future development.** — Yale Brozen. *Research/Development,* v. 12, Aug. 1961, p. 64 + 10 pages.

* Realistic **Research Administration** — Harold W. Rice. *Industrial Research,* v. 3, no. 3, June-July 1961, p. 62-67.

* Industrial **Research Management** and **Creativity** — Harold W. Mohrman. *Royal Australian Chemical Institute, Proceedings,* v. 28, May 1961, p. 173-178.

* The Pursuit of Excellence — The author asserts that a nation involved in a race for space, striving for world-wide prestige, advancing in technological know-how to a degree never before achieved, should pay serious attention to developing an **educational system** that will enable tomorrow's generations to support and build on today's accomplishments. — Paul J. Grogan. *American Engineer,* v. 31, July 1961, p. 29 + 4 pages.

AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

* The National Program for Lunar and **Planetary Exploration** — The National Aeronautics and Space Administration has assigned to the Jet Propulsion Laboratory the responsibility for design and development of **spacecraft** for the exploration of the moon, the planets, and interplanetary space. In carrying out its assignment, JPL, the United States' oldest guided-missile and rocket-research laboratory, is designing and fabricating spacecraft to be flown past the moon and to land scientific equipment on the surface of the moon. Designs have also begun for spacecraft to fly past the planets and land capsules of scientific instruments on the planetary surfaces. This paper describes the **Ranger** spacecraft, now undergoing assembly, which will initiate the **lunar exploration** program; the **Mariner,** now being designed, which will initiate the planetary program with a flight past Venus; and the **Surveyor,** in which packages of scientific instruments will be soft-landed on the moon. — A. R. Hibbs. *Journal of Geophysical Research,* v. 66, no. 7, July 1961, p. 2003-2012.

*** Asterisks mark items that may be used in the Battelle Library only. None of the unbound materials listed are available for interlibrary loan.**

Velocity Requirements for **Abort** From the **Boost Trajectory** of a **Manned Lunar Mission** – An investigation is made of the **abort velocity requirements** associated with failure of a propulsion system for a **manned lunar mission.** Two cases are considered: abort at less than satellite speed, which results in maximum decelerations in the following entry, and abort at greater than satellite speed with immediate return to earth. It is found that abort rockets sufficient for abort at greater than satellite speed can be used to reduce maximum decelerations in entries following an abort at lower speeds. This reduction is accomplished by use of the abort rockets to decrease entry angle immediately prior to entry into the atmosphere. – Robert E. Slye. *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-1038, July 1961, 41 pp. (TL570 Un3t Room 290)

On the Long Period Luni-Solar Effect in the Motion of an **Artificial Satellite** – Two systems of formulas are presented for the determination of the long period perturbations caused by the Sun and the Moon in the motion of an artificial satellite. The first system can be used to determine the lunar effect for all satellites. The second method is more convenient for finding the **lunar effect** for close satellites and the **solar effect** for all satellites. Knowledge of these effects is essential for determining the stability of the satellite orbit. The basic equations of both systems are arranged in a form which permits the use of numerical integration. The two theories are more accurate and more adaptable to the use of electronic machines than the analytical developments obtained previously. – Peter Musen. *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-1041, July 1961, 17 pp. (TL570 Un3t Vis.)

The **Aerothermodynamic Behavior** of Pyrolytic Graphite During Sustained **Hypersonic Flight** – A detailed study is presented of the performance of **pyrolytic graphite** over the surface of the vehicle, including such critical locations as the leading edge and forward stagnation point. The surface oxidation rate and multidimensional temperature response were determined for various glide trajectories. – E. J. Nolan and S. M. Scala. *General Electric Company, Technical Information Series, No.* R61SD051, Mar. 1961, 46 pp. + charts. (T1 G28t Contin.)

Aerodynamic Force Characteristics of a Series of Lifting Cone and Cone-Cylinder Configurations at a **Mach Number of 6.83** and Angles of Attack Up to 130° – A comparison of the experimental data of both cone and **cone-cylinder configurations** with theoretical calculations, shows that the Newtonian concept gives excellent predictions of trends of the force characteristics and the locations, with respect to angle of attack of the points of maximum lift, maximum drag, and maximum lift-drag ratio. – Jim A. Penland. *U. S. National Aeronautics and Space Administration, Technical Note, NASA-TN*-D-840, June 1961, 45 pp. (TL570 Un3t Room 290)

Analytical Evaluation of a Method of **Midcourse Guidance** for Rendezvous With **Earth Satellites** – A digital-computer simulation was made of the midcourse of ascent phase of a rendezvous between a **ferry vehicle** and a space station. The simulation involved a closed-loop guidance system in which both the relative position and relative velocity between ferry and station are measured (by simulated radar) and the relative-velocity corrections required to null the miss distance are computed and applied. – John M. Eggleston and Robert S. Dunning. *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-883, June 1961, 61 pp. (TL570 Un3t Room 290)

Aerodynamic Characteristics at a Mach Number of 3.10 of Several Fourth-Stage Shapes of the **Scout Research Vehicle** – Wind-tunnel investigation at **Mach 3.1.** Except for the axial force and pitching-moment slope, the experimental trends or magnitudes could not be estimated with the desired accuracy by Newtonian or slender body theory. – Byron M. Jaquet. *U. S. National Aeronautics and Space Administration, Techincal Note, NASA TN*-D-916, June 1961, 17 pp. (TL570 Un3t Room 290)

Drag Measurements on Circular Cylinders and Spheres in the Transition Regime at a **Mach Number of 2** – Measurements of the drag of **circular cylinders** placed transverse to the flow and **spheres** at a Mach number of 2 in air were obtained in the UTIA low density wind tunnel. The mean free path of the air in the test flow was 0.049" and the model sizes were such that Knudsen numbers in the range 0.2 to 6 for the cylinders

and 0.1 to 0.8 for the spheres were covered. The drag coefficient of circular cylinders calculated from the measured forces was found to increase with increasing Knudsen number and to reach a value of 3.02 at Kn=3. – A. K. Sreekanth. *Toronto University, Institute of Aerophysics, UTIA Report No.* 74, Apr. 1961, 44 pp. + 39 pp. supplementary material. (TL570 T64.84a Vis.)

The Motion of a **Satellite** Under the Influence of a Constant Normal **Thrust** – The motion of a satellite in a central inverse-square-law force field, subject to a constant thrust, normal to the instantaneous plane of motion is considered. An exact closed-form solution is given for the case of initially circular orbits, and approximate closed-form solutions are found for initially elliptical orbits, using the methods of Kryloff, Bogoliuboff, and Poincaré. – Harry Lass and Carleton B. Solloway. *California Institute of Technology, Jet Propulsion Laboratory, Technical Report No.* 32-79, 7 pp. (TL501 C12.4t Contin.)

Mission to Venus – The theory behind the **Russian space rocket** which was sent to **Venus.** – *Spaceflight*, v. 3, no. 4, July 1961, p. 114-119.

AGRICULTURE

The Translocation and **Persistence** of Tritium-Labeled Cycloheximide in Eastern White Pine Seedlings – Cycloheximide, a **systemic plant fungicide,** was taken up from a stem application and distributed to the upper stem and needles, but was not translocated to the roots. There was no **translocation** downward from a foliar application. The translocated antibiotic persisted in the untreated tissue without detectable degradation for 2 months. – A. J. Lemin and R. C. Thomas. *Journal of Agricultural and Food Chemistry*, v. 9, July-Aug. 1961, p. 254-256.

The Effect of Coatings on the **Dissolution** of Fertilizers and the **Uptake** of Fertilizer Potassium by Plants – Several fertilizers containing potassium were coated with vinyl acetate, acrylic resin spray, paraffin, and polyethylene emulsion to alter their dissolution properties. Leaching losses of potassium were significantly reduced by several coating materials. Germination of wheat seed in contact with uncoated fertilizer and emergence of seedlings were lower than with similar placement of **coated fertilizer** in greenhouse trials. – Kirk Lawton. *Journal of Agricultural and Food Chemistry*, v. 9, July-Aug. 1961, p. 276-280.

Gaseous Loss of Ammonia from Surface-Applied **Nitrogenous Fertilizers** – Losses following **surface application** of 100 lbs. of urea nitrogen averaged 29% for unlimed turf and 39% for limed turf. Respective losses from $(NH_4)_2SO_4$ were 0.4 and 19.7%; and from NH_4NO_3, 0.3 and 3.4%. **Ammonia losses** from urea surface-applied to bare sandy soil averaged 25% in 7 days, while loss from NH_4NO_3 was negligible. – Gaylord M. Volk. *Journal of Agricultural and Food Chemistry*, v. 9, July-Aug. 1961, p. 280-283.

Advances in Chemistry Series, No. 28. **Gibberellins** – A collection of papers comprising the Symposium on Gibberellins, presented before the Division of Agricultural and Food Chemistry at the 138th National Meeting of the American Chemical Society, New York, September 1960. – Robert F. Gould, editor. 167 pp. 1961. American Chemical Society, Washington, D.C. (QK746 Sy68g)

BIOCHEMISTRY AND BIOPHYSICS

The **Processing of Information** in the Neuron – The extremely diversified connection of the **neurons** in the central nervous system cannot be subjected to complete direct observation. The results show that models must carefully take into account the properties of the individual cell, if they are to yield real information on what occurs in the organism. (*In German.*) Über die Nachrichtenverarbeitung in der Nervenzelle. – K. Küpfmüller and F. Jenik. *Kybernetik*, v. 1, no. 1, Jan. 1961, p. 1-6.

• Quantification of the **Antigen-Antibody Reaction** by the Polarization of Fluorescence – Authors conclude that it is possible to determine by measurements of **fluorescence polarization** two important parameters, namely the equilibrium constant and the combining capacity characterizing the antigen-antibody reaction. The **combining capacity is** proportional to the number of antibody sites in a preparation and the equilibrium constant, together, perhaps, with certain kinetic quantities, constitutes a quantitative measure of avidity. – W. B. Dandliker and G. A. Feigen. *Biochemical and Biophysical Research Communications*, v. 5, no. 4, July 26, 1961, p. 299-304.

• The **Spectral Sensitivity** of Crayfish and Lobster **Vision** – Donald Kennedy and Merle S. Bruno. *Journal of General Physiology*, v. 44, no. 6, July 1961, p. 1089-1102.

• Production of **Interferon** by Brains of Genetically Resistant and Susceptible Mice Infected With West Nile Virus – The results suggest that interferon plays no role in the resistance of BRVR mice to West Nile virus (and probably the entire Arbor B group) and that factor(s) in **genetic resistance** to infections are expressed through mechanisms other than the production of interferon *in vivo*. – Tapani Vainio, Ralph Gwatkin, and Hilary Koprowski. *Virology*, v. 14, no. 3, July 1961, p. 385-387.

• Reversibility of the Reaction Between Poliovirus and **Neutralizing Antibody** of Rabbit Origin – **Virus reactivation** occurs quantitatively when the pH of the reaction mixture is reduced to between 2.5 and 2.0. That reactivation is the result of dissociation and not of denaturation of antibody is shown by the unimpaired capacity of the reactivated mixture to undergo reneutralization when the pH is readjusted to neutrality. After prolonged contact (4 months at 5°) of virus with antibody, infectious virus can be recovered nearly quantitatively by pH dissociation. This result indicates that the neutralization of virus by antibody is not necessarily accompanied by permanent or irreversible changes in the viral particle. – Benjamin Mandel. *Virology*, v. 14, no. 3, July 1961, p. 316-328.

• The Learning Matrix – Describes a feed control structure combining "conditioned reflexes" in such a way that **learning processes** are obtained through a learning phase and a capacity phase. The learning matrix can be used for the automatic identification of signs, language, the general decoding of learned or eventually disturbed signs, and for information retrieval; it is a useful instrument in connection with the semantic information theory and for the understanding of the **communication process** in man. (*In German.*) Die Lernmatrix. – K. Steinbuch. *Kybernetik*, v. 1, no. 1, Jan. 1961, p. 36-45.

Infectious Nucleic Acids, a New Dimension in Virology – Viral nucleic acids have been found to be infectious for tissues and animals, yet are nonantigenic and resistant to antibodies against whole virus. – Roger M. Herriott. *Science*, v. 134, July 28, 1961, p. 256-260.

Reaction of Human Sera With Mammalian **Chromosomes** Shown by Fluorescent Antibody Technique – **Antinuclear sera** are studied. – Robert S. Krooth, John E. Tobie, J. H. Tjio, and Howard C. Goodman. *Science*, v. 134, July 28, 1961, p. 284-286.

• The Chemical Nature of **Organ-Determining Substances** in the Early Development of Embryos – Heinz Tiedemann, Kurt Kesselring, Ursula Becker, and Hildegard Tiedemann. *Biochemica et Biophysica Acta*, v. 49, no. 3, May 27, 1961, p. 603-605.

• Isolation and Characteristic of **Ribonucleic Acid** of the Chromosomal Nucleolar Apparatus – (*In Russian.*) Vydelenie i kharakteristika ribonukleinovoĭ kisloty khromosomnoiadryshkovogo apparata. – G. P. Georgiev. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 2, May 1961, p. 458-461.

Harmonic Oscillation as Model for **Cortical Excitability** Changes With Attention in Cats – Walter J. Freeman. *Science*, v. 133, June 30, 1961, p. 2058-2059.

Psychological and Social Problems of Man in Space--a Literature Survey – It is the purpose of this bibliography to bring together the reports, books and periodical articles published through the early part of 1961 dealing with the specific area of behavioral science related to **space flight.** This area includes problems of confinement, isolation, **sensory deprivation,** weightlessness, psychological assessment and training, motivation and morale, emotional stability, boredom and fatigue, performance under stress, and work load. – B. D. Goodman. *ARS Journal*, v. 31, July 1961, p. 863-872.

Construction of a **Neuron Model** – An application of a linear programming technique to the economical construction of the model is described. – Robert J. Scott. *IRE Transactions on Bio-Medical Electronics*, v. BME-8, no. 3, July 1961, p. 198-202. (TK1 In6.6m Vis.)

Analysis of Polarized Light by the Bee's Eye – Discusses mechanisms by which **insect navigation** based on polarized-light sensitivity may operate. – Donald Kennedy and Edward R. Baylor. *Nature*, v. 191, July 1, 1961, p. 34-37.

• Genetic Regulatory Mechanisms in the Synthesis of Proteins – **Enzyme synthesis** in bacteria follows a double genetic control. The so-called structural genes determine the molecular organization of the proteins. Other functionally specialized, **genetic determinants,** called regulator and operator genes, control the rate of protein synthesis through the intermediacy of cytoplasmic components or repressors. The repressors can be either inactivated (induction) or activated (repression) by certain specific metabolites. This system of regulation appears to operate directly at the level of the synthesis by the gene of a short-lived intermediate, or messenger, which becomes associated with the ribosomes where protein synthesis takes place. – François Jacob and Jacques Monod. *Journal of Molecular Biology*, v. 3, no. 3, June 1961, p. 318-356.

Drugs in the **Brain** – Autoradiography and radioassay techniques permit analysis of **drug penetration** by labeled drugs. – Lloyd J. Roth and Charles F. Barlow. *Science*, v. 134, July 7, 1961, p. 22-31.

A Molecular Theory of General **Anesthesia** – Anesthesia is attributed to the formation in the brain of minute hydrate crystals of the clathrate type. – Linus Pauling. *Science*, v. 134, July 7, 1961, p. 15-21.

Unusual Base Composition of the **Ribonucleic Acid** of Wild Cucumber Mosaic Virus – H. Yamazaki and Paul Kaesberg. *Nature*, v. 191, July 1, 1961, p. 96-97.

CERAMICS AND CONCRETE

• **Coarse Pored Concrete** Made With Porous Aggregates – Studies showed the possibility and expediency of the production of coarse pored concrete **with porous aggregates** not only for heat-insulating but also for large building panels. (*In Russian.*) Krupnoporistyi beton na poristykh zapolniteliakh. – I. A. Dikovsky. *Beton i Zhelezobeton*, 1961, no. 6, June, p. 249-254.

Rocket Nozzle Environment Tests on an **SiC Ceramic** – Nozzle liners of a silicon carbide ceramic were evaluated under various firing conditions in a laboratory-scale rocket motor burning gaseous hydrogen and oxygen. Data from tests using large liquid-propellant motors showed a similar effect on **service life** of this material. As the failure mechanism appeared to be the same, it was concluded that the laboratory motor may provide a means to obtain engineering estimates of the service life of practical **rocket nozzles.** – James F. Lynch, Edward E. Ungar, and Winston H. Duckworth. *American Ceramic Society Bulletin*, v. 40, July 1961, p. 445-449.

• Increase in Strength of Thin Glass – Experimental results show that in all cases the **thermochemical treatment** considerably increases its glass strength, the pickling yields the same or a somewhat greater strengthening (especially for glass of 1.5 mm thickness), and that the greatest strengthening is obtained by a consecutive glass treatment, first by the thermochemical method and then by pickling. (*In Russian.*) Povyshenie prochnosti tonkogo stekla. – I. A. Boguslavskii, F. F. Vitman, and V. P. Pukh. *Akademii Nauk SSSR, Doklady*, v. 138, no. 5, 1961, p. 1062-1065.

• Properties of an Expansive Cement for Chemical **Prestressing** – Expansion characteristics and compressive strengths were determined for **concretes** containing **expansive cement** to evaluate the factors relating to control of the expansive reaction. –

Alexander Klein, Tsevi Karby, and Milos Polivka. *American Concrete Institute, Journal*, v. 58, no. 1, July 1961, p. 59-82.

Investigation of Elastic and Thermal Properties of **Carbon-Base Bodies** – The **elastic properties** and permanent set were investigated at room temperature for C made of graphitized filler (soft and hard) and for C impregnated in the baked or graphitized state in dependence on the heat-treatment temperature. Several **thermal properties** were also investigated. – S. Mrozowski, et al. *U. S. Air Force, Wright Air Development Division, WADC Technical Report* 58-360, pt. 3, Feb. 1961, 54 pp. (TL570 Un3.18w Vis.)

• Progress With **Refractory Fibres** – Discusses **high-temperature insulation** materials which are based on refractory fibres, including various forms of Refrasil, potassium titanate, graphite, and zirconium dioxide. – C. Z. Carroll-Porczynski. *Engineering Materials and Design*, v. 4, July 1961, p. 418-424.

• An Electron Microscope Study of the Structure of **Sodium-Boron Silicate Glass** – Glass of the composition Na_2O 7, B_2O_3 23 and SiO_2 70 (in mol.%) was studied. The changes in **structure** of this glass occuring with increase in the duration of heat treatment were investigated at a constant temperature of 645° and at temperatures between 695-755°. (*In Russian.*) Elektronnomikroskopicheskoe issledovanie structury natrievoborosilikatnykh stekol. – V. I. Sheliubskii and N. M. Vaisfel'd. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 1, May-June 1961, p. 100-101 + 1 plate.

Preparation of Minus 10 Micron **Dense UO_2** – A 100%-yield process was developed for the preparation of relatively free-flowing dense UO_2 powder with less than 0.01 w/o +325 mesh, no +10 micron particles detectable with a Sartorius Sedimentation Balance, less than 10 w/o –2 microns, loose bulk density of about 4 g/cm³, and particle density of about 10.9 g/cm³ by He displacement. This UO_2 powder can be prepared by simple steps not involving classification. – M. C. Tinkle, et al. *U. S. Atomic Energy Commission, LA*-2521, May 25, 1961, 21 pp. (UF767 U3La Contin.)

CHEMICAL ENGINEERING

• **Nucleate Pool Boiling** – Nucleate pool boiling is boiling carried out in the simplest manner possible. The fluid is a pool of liquid with its bulk at the saturation temperature. No forced convection is employed. The heat source is a hot solid surface, and in this article the liquid is considered to be a single pure component. – J. W. Westwater. *Petro/Chem Engineer*, v. 33, Aug. 1961, p. 40-43.

• **Solids-Air Jets** – An approach which casts light on some outstanding problems such as maximum spoutable bed depths, variance in **spouting characteristics** of various solids and **solids spout diameters** is followed. There is a close similarity of spouting to channeling under fluidizing conditions in a bed. – L. A. Madonna, R. F. Lama, and W. L. Brisson. *British Chemical Engineering*, v. 6, Aug. 1961, p. 524-528.

Hot Carbonate Solutions Do Not Degrade When Used **for H_2S Removal** – Even after prolonged use with a high ratio of CO_2 and H_2S in the feed, solution will not deteriorate. High absorption efficiency and capacity were maintained through a 25-day run. – R. N. Tennyson. *Oil and Gas Journal*, v. 59, no. 32, Aug. 7, 1961, p. 109-111.

• Thermal Effects in **Urea:** The **Crystal Structure** at –140°C. and at Room Temperature – Natalie Sklar, Michael E. Senko, and Ben Post. *Acta Crystallographica*, v. 14, pt. 7, July 10, 1961, p. 716-720.

• **Mass Transfer** Through **Laminar Boundary Layers.** III. Similar Solutions of the *b*-Equation – New solutions are presented valid for a two-parameter family of velocity distributions. It is shown that these suffice for the approximate prediction of the dimensionless conductance for a wide range of the variables: Prandtl/Schmidt number, Euler number, and driving force. – D. B. Spalding and H. L. Evans. *International Journal of Heat and Mass Transfer*, v. 2, no. 4, June 1961, p. 314-341.

Zone Freezing Unit Purifies Chemicals – Continuous process separates, **purifies organics,** yields products of more than 99.9% purity. – *Chemical & Engineering News*, v. 39, no. 31, July 31, 1961, p. 46-47. a

Designing **Turbulent-Flow Systems** – A new correlation is presented for data on non-Newtonian turbulent flow. Scaleup methods are illustrated by use of data from the literature. – Richard LeBaron Bowen, Jr. *Chemical Engineering*, v. 68, July 24, 1961, p. 143-150.

b • An Introduction to **Air-Cooled Heat Exchangers** – R. J. Anderson. *British Chemical Engineering*, v. 6, July 1961, p. 468-473.

• Mechanical Design of **Distillation Columns.** III – Deals with the **design** of bubble and grid trays, distributor rings, and their supports. – F. Molyneux. *Mechanical World and Engineering Record*, v. 141, July 1961, p. 247-249. c

• **Distillation** . . . in View of Modern Developments. III. **Mass Transfer** – Gas phase diffusion; liquid phase diffusion; efficiencies; assumptions and limitations; tray efficiency definitions; variables that affect efficiency; other prediction methods. – Kenneth F. Gordon and James A. Davies. *Petro/Chem Engineer*, v. 33, July 1961, p. C-7 + 12 pages.

d Dynamics of **Solid-Liquid Fluidization** – Experimental data for liquid-solid fluidized systems are correlated with modifications of the drag force-Reynolds number relationship for single, fixed particles and with a modified form of the Karman-Kozeny equation for fixed beds. – S. H. Bransom and S. Pendse. *Industrial and Engineering Chemistry*, v. 53, July 1961, p. 575-576.

e • **Electric Resistance Furnaces** for the Production of Yellow Phosphorus – After a short explanation of **yellow phosphorus production,** the mode of operation of a modern furnace installation is described. The basic circuits for the transformers, and their variable reactance, are discussed, if the furnace voltage varies within wide limits. (*In German.*) Elektrische Widerstandsöfen zum Erzeugen von gelbem Phosphor. – Günter Breil and Karl Schlosser. *ETZ: Elektrotechnische Zeitschrift*, v. 13, Ausgabe B, no. 12, June 1961, p. 327-333. f

Applications of **Filtration Equipment** – Major factors entering into filter **applications** are process requirements, maintenance costs, operating costs, and financing. Presents the major components in each category for the filter station and suggests methods of reducing each factor to a numerical value. One of four papers in a symposium on filtration. – R. H. Van Note and F. T. Weems. *Industrial and Engineering Chemistry*, v. 53, July 1961, p. 546-551. g

• **Computers** for the Chemical Engineer – Papers dealing with the different applications of computers in **chemical engineering** are: "Computers and Programming", "Plant Management Applications", "Computers in Distillation Dynamics Research", "The Need for More Process Control Computation", "Simple Computing Relays", "Anatrol--an Analogue On-Line Process Control Computer", and "The Argus Digital Computer in Process Control". – J. S. M. Botterill. *British Chemical Engineering*, v. 6, July 1961, p. 481-484. h

i • A **Rectifying Column** for Difficult Separations – The Kuhn rectifying column has been adapted to industrial requirements by Sulzer Bros. working in cooperation with the inventor. The Kuhn column offers advantages wherever difficult mixtures have to be separated and conventional methods of **separation** would require extremely long columns. – Max Huber. *British Chemical Engineering*, v. 6, July 1961, p. 459-465.

j • The Two Phase **Boundary Layer** in Laminar Film Condensation – Consideration is given to the two-phase flow problem in **laminar film condensation,** which arises when induced motions of the vapor are included. – J. C. Y. Koh, E. M. Sparrow, and J. P. Hartnett. *International Journal of Heat and Mass Transfer*, v. 2, nos. 1-2, Mar. 1961, p. 69-82.

k Pressuring **Ilmenite for Pigments** – Because the new process can utilize leaner ores and requires less acid than that used in existing plants, it offers greater flexibility and economy in operation. *Chemical Week*, v. 89, no. 3, July 22, 1961, p. 70-72.

• Design Tips for **Cryogenic Storage Vessels** – Size, working pressure, evaporation losses, insulation, maintenance of vacuum, and method of filling must all be carefully considered for most economical **design.** – G. F. Sulfrian. *Chemical Processing*, v. 24, July 1961, p. 31-34.

• The Effect of Some **Added Cations** on the Caking of Spectrally Pure **Magnesium Oxide** – The effect of the addition of small amounts of cations, with different crystallochemical characteristics on **caking,** were studied. (*In Russian.*) Vliianie primesei nekotorykh kationov na spekanie spektral'no chistoi okisi magniia. – P. P. Budnikov, T. N. Keshishian, and V. K. Ianovskii. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 2, May 1961, p. 365-368.

• Maximum Conversion in Some Simple **Reaction Systems** – Formulae and tables are given, with which it is possible for some typical reaction systems to calculate the **maximum yield of** the desired product. (*In German.*) Der maximale Umsatz bei einigen einfachen Reaktionssystemen. – F. Horn and U. Troltenier. *Chemie-Ingenieur-Technik*, v. 33, June 1961, p. 413-416.

How to Figure **Transfer Units** From Theoretical Plates – Applies to **distillation column** design. – A. J. Surowiec. *Chemical Engineering*, v. 68, July 10, 1961, p. 139-140.

CHEMISTRY—ANALYTICAL (ORGANIC AND INORGANIC)

Determination of Potassium in Silicate Minerals and Rocks by **Neutron Activation Analysis** – The determination of potassium **in silicate minerals** by pile neutron activation and by counting the induced β radiation in the irradiated specimen without chemical processing is described. An end-window proportional counter and Al absorbers are used for radioactivity measurement. Precision and absolute accuracy of the method are of the order of 1%, and interference by trace elements in general is less than this. Results are presented for the analysis of the standard granite G-1, diabase W-1, argillaceous limestone NBS No. 1a, feldspar NBS No. 70, and biotite M.I.T. No. B3203. – John W. Winchester. *Analytical Chemistry*, v. 33, July 1961, p. 1007-1012.

Separation of Trace Elements in Plant Materials From Ferric Iron by **Cation Exchange Chromatography** – In a recent study of the equilibrium distribution coefficients of cations with AG 50W-X8 resins in nitric acid, differences between the K_d values of Fe(III) and many of the bivalent heavy metals were noticed. This fact was used to develop a cation exchange chromatographic procedure for the separation of trace amounts of Pb(II), Mn(II), Cu(II), Ni(II), Co(II), Zn(II), and Ti(IV), in the presence of Fe(III), from South African **plant materials.** The method can be extended to 100- to 150-mg. amounts in the case of the separation of Ti and Ni from iron. Mo(V) and V(V) are separated from iron at the same time, and the method can be modified to separate tin(IV) as well. Percentage recoveries for about 100-μg. amounts of the trace elements are given. – F. W. E. Strelow. *Analytical Chemistry*, v. 33, July 1961, p. 994-997.

Analysis of Fat Acid **Oxidation Products** by Countercurrent Distribution Methods. V. Low-Temperature Decomposition of **Methyl Linoleate Hydroperoxide** – Methyl *cis,trans* diene conjugated linoleate hydroperoxide isolated by countercurrent distribution from 4 C autoxidation of methyl linoleate was stored in atmospheres of O and of N at 4 C in darkness. Besides manometric changes, infrared and ultraviolet characteristics, peroxide value, diene conjugation, and molecular weights were followed on samples removed at various periods of storage up to 53 days. These same analyses were obtained on fractions obtained by counter-current distribution. – A. E. Johnston, K. T. Zilch, E. Selke, and H. J. Dutton. *American Oil Chemists' Society, Journal*, v. 38, July 1961, p. 367-371.

• Spectrophotometric Method for the Determination of Microgram Amounts of **Titanium** With the Azo Dye Solochrome Black RN – The **microdetermination method** described uses this compound in methanol-hydrochloric acid solution. The dye formed with Ti is a blue-violet complex which exhibits maxium extinction at 570 mμ. As low as 0.2 ppm Ti can be determined by this method. (*In German.*) Spektrophotometrische Methode zur Bestimmung von Mikrogrammengen Titan mit dem Azofarbstoff Solochromschwarz RN. – J. Korkisch. *Zeitschrift für Analytische Chemie*, v. 182, no. 2, 1961, p. 92-96.

• Investigation and Analytical Use of **p-Hydroxy-m-Nitrophenyl-Arsonic Acid** – This acid can be titrated as a tri-basic acid. It yields large metal ion depositions. The corresponding acid salts are quite suitable for the **gravimetric determination of metals** such as Pb, Zn, Cd, Hg(II), Mn, Sn, Zr and Th. (*In German.*) Untersuchung und analytische Anwendung der p-Hydroxy-m-nitrophenyl-arsonsäure. – F. Szabadváry, J. Takács, and L. Erdey. *Zeitschrift für Analytische Chemie*, v. 182, no. 2, 1961, p. 88-92.

• Indication of Small Traces of **H_2O in D_2O** by Infra-Red Absorption – Measurement of infrared absorption is particularly suited in the **microdetermination** of small traces of H_2O in D_2O. The wave-length range, around 1.47μ, has been found to be particularly suitable for the analysis. A method of measurement for individual samples using a spectrophotometer and a continuously operating plant measuring apparatus is described. Use is made of a quotient method given by K. Hoffman. Since at the relatively short wave-lengths glass can be employed for the optical parts of the apparatus, a robust and accurate instrument is obtained with simple means. (*In German.*) Nachweis geringer Mengen H_2O in D_2O durch Infrarot-Absorption. – Friedrich Gläser. *Chemie-Ingenieur-Technik*, v. 33, June 1961, p. 443-445.

• Analysis of **Iron Ores** by Flame Spectrophotometry – Describes method of **spectrophotometric analysis.** Owing to the addition of high concentrations of oxine to the unknown solution, and to the standard solutions, whose emitting intensities for each element in the oxyacetylene flame is measured according to the characteristic wave length of this element, it is possible to quantitatively and directly determine Fe, Ca, Mg, Mn, Al, Na, and Sr without any separation in Fe ores from the Lorraine district. The presence of the organic reagent increases the intensity of the spectra and eliminates the chemical disturbances usually caused by the presence of other anions and cations in the solution. (*In French.*) Analyse des minerais de fer par usually caused by the presence of other anions and cations in spectrophotométrie de flamme. – J. Debras-Guédon and I. Voïnovitch. *Chimie Analytique*, v. 43, June 1961, p. 267-275.

• Quantitative **Spectrophotometric Determination** of **Arsenic in Steels** – (*In French.*) Dosage spectrophotométrique de l'arsenic dans les aciers. – Élisabeth Migeon and Jean Migeon. *Chimie Analytique*, v. 43, June 1961, p. 276-279.

• Titrimetric Methods for the **Microdetermination of Halogens** in Organic Compounds by the Rapid Combustion Procedure. II. The **Simultaneous Determination** of the Halogens in the Presence of Each Other – The absorption of the gaseous combustion products from the rapid, empty tube **combustion procedure** has been studied. Organic compounds containing any combination of Cl, Br, and I as well as O, N, and S have been examined. Several methods based on established titration procedures have been developed for the simultaneous microdetermination of any two or all three halogens in organic materials. – R. Belcher and J. E. Fildes. *Analytica Chimica Acta*, v. 25, no. 1, July 1961, p. 34-41.

• Synthetic Tests in the Group of **Hypotensively Active Alkaloids.** XVII. Simplified Method of Synthesis of (±)-**Deserpidine** and Allied Substances – By using suitable alicyclic components, the end phases of **synthesis** of substances of the reserpine type were abridged to such a point, that from the end products, intermediate products were isolated only at one stage. In addition to deserpidine and isodeserpidine, previously unknown isoreserpine and 3,4,5-trimethoxydihydrocinnamon acid ester and *p*-nitrobenzoacid ester of the isodeserpidine acid methyl ester were obtained. (*In German.*) Synthetische Versuche in der Gruppe hypotensiv wirksamer Alkaloid. XVII. Vereinfachte Methode der Synthese von (±)-Deserpidin und verwandten Substanzen. – J. Weichet, K. Pelz, and L. Bláha. *Collection of Czechoslovak Chemical Communications*, v. 26, no. 6, June 1961, p. 1529-1536.

• Analysis of **Arsenic-Iron Alloys** – Contrary to expectation, and to published recommendation, it is not possible to separate Fe(III) quantitatively from As(V) on a cation-exchange resin.

Ion-exchange can, however, be utilized for the **analytical separation** of Fe and As if the Fe is reduced to Fe(II) before the mixture is passed through the cation-exchange column. – G. R. Duval, R. Ironside, and D. S. Russell. *Analytica Chimica Acta*, v. 25, no. 1, July 1961, p. 51-56.

Treatise on Analytical Chemistry. I. Theory and Practice – This book has been designed to be a complete and definitive source of information for all analytical chemists, and to stimulate fundamental research in pure and applied analytical chemistry by treating the scientific and instrumental fundamentals of all analytical methods, by critically selecting and interpreting methods and procedures for all inorganic and organic compounds, and by presenting methods for investigation and evaluation of the properties and composition of commercial products. – I. M. Kolthoff, Philip J. Elving, and Ernest B. Sandell, editors. v. III. 440 pp. 1961. Interscience Publishers, New York. (QD75 K83t)

Our new format should help you scan the page quickly. Boldface clue words identify subject matter. Titles appear unchanged at the beginning of each abstract.

* **Chelatometry Applications.** XI. Volumetric Quantitative Determination of **Aluminum Alkylates** – Such alkylates can be quantitatively determined by chelatometry after being decomposed by hydrochloric acid. The Al chloride formed is made complex by disodium ethylenediamine-tetracetate whose excess is measured by means of a Cu salt in the presence of pyrocatechin violet in this method of **quantitative analysis.** (*In French.*) Applications de la chélatométrie. XI. Dosage volumétrique des alkylates d'aluminium. – Claude Hennart. *Chimie Analytique*, v. 43, June 1961, p. 283-285.

Rapid Determination of **Organic Hydroxyl Groups** With 3,5-Dinitrobenzoyl Chloride – **3,5-Dinitrobenzoyl chloride,** commonly used for the identification of alcohols, reacts rapidly and quantitatively with organic hydroxyl groups in pyridine. This reaction, followed by a visual or potentiometric titration of the reaction products, provides another simple procedure for the **determination** of primary and secondary alcohols. Polyols, sugars, phenols, primary and secondary amines, and some oximes may also be determined. By employing a longer reaction period, a much wider range of tertiary alcohols may be determined than by existing procedures. Ketones do not interfere nor do aldehydes unless they exceed 40% of the alcohol being determined. – W. T. Robinson, Jr., R. H. Cundiff, and P. C. Markunas. *Analytical Chemistry*, v. 33, July 1961, p. 1030-1034.

Determining Compositions of Labeled **Ethylene-Propylene Copolymers** – The compositions of labeled ethylene-propylene copolymer standards can be determined by a method involving liquid-scintillation counting. The copolymers are dissolved by heating in a liquid scintillator, cooled, and counted as gels or suspensions. Counting efficiencies of 70% have been obtained on such samples containing 0.5 gram of copolymer. The method of **composition determination** should also be applicable to other labeled copolymers. – R. L. Stoffer and W. E. Smith. *Analytical Chemistry*, v. 33, July 1961, p. 1112-1113.

CHEMISTRY—INORGANIC AND GENERAL

A Study of the Tetraborides of Uranium and Thorium – **Thorium tetraboride** and **uranium tetraboride** were prepared by direct synthesis in an inert atmosphere and test specimens of the tetraborides of almost theoretical density were fabricated by powder metallurgical techniques. **Physical and mechanical properties** of the borides were evaluated and a study was made of the corrosive action of O, carbon dioxide, and dry H up to temperatures of 1,000 C. – K. J. Matterson and H. Jones. *British Ceramic Society, Transactions*, v. 60, July 1961, p. 475-493.

a • * Inorganic Reactions of **Alkali Metal Borohydrides** – The alkali metal borohydrides, $M(BH_4)$, are of great importance for the preparation of H compounds, metal borohydride metallates, $M[M'(BH_4)n]m$, and derivatives of boron hydrides. The advances obtained in this domain in the last decade are summarized. (*In German.*) Anorganische Reaktionen der Alkaliboranate. – H. Nöth. *Angewandte Chemie*, v. 73, no. 11, June 7, 1961, p. 371-383.

b • * **Halogen Nitrates** and Their Reactions. The Chemistry of Positive Oxydation Stages of Halogens – The reaction of Cl_2O with N_2O_5 makes it possible to obtain NO_2Cl as a key substance for all further halogen nitrates on a preparative scale. To judge by its behavior it is to be considered as a "chlorine nitrate", $ClNO_3$. Chlorine nitrate is suitable for the preparation of inorganic acyl nitrates. Further, the halogen nitrates $BrNO_3$, $Br(NO_3)_3$, BrN_2NO_3, INO_3 and $I(NO_3)_3$ could be prepared and their reactions with halides and oxides studied. These investigations were experimentally confirmed by the fact that the halogen nitrates obtained could be converted with pyridine (and other N-bases) into the corresponding previously described complex compounds. The study of $ClNO_3$ permitted a systematic comparison of the **nitrogen-oxygen-chlorine compounds** NOCl, NO_2Cl and NO_3Cl). (*In German.*) Halogennitrate und ihre Reaktionen. Zur Chemie der positiven Oxydationsstufen der Halogene. – M. Schmeisser and K. Brändle. *Angewandte Chemie*, v. 73, no. 11, June 7, 1961, p. 388-393.

d • * **Specific Electroconductivity** of Aqueous Potassium Chloride Solutions at High Temperatures – Specific electroconductivity data of 0.05, 0.10, 0.25, 0.50 and 1.0 molal aqueous **potassium chloride solutions** have been obtained over the temperature range 25-300 C at temperature intervals of 25° under conditions excluding concentration changes. The curve $\mu = f(t)$ has been shown to possess two characteristic points for the KCl solutions over the range 25-300°, namely a specific electroconductivity peak and a point of inflection. In logarithmic coordinates the specific electroconductivity-molal KCl relation has been shown to be linear over the entire temperature range investigated and over a broad range of concentrations. The effect of temperature on the electroconductivity diminishes with increasing KCl concentration. An approximate formula has been proposed for calculating the specific electroconductivity of KCl solutions within the temperature range 25-300° and concentrations not exceeding 1M. Deviation of the theoretical from the experimental results of the present study does not exeed 5%. (*In Russian.*) Udel'naia elektroprovodnost' vodnykh rastvorov khloristogo kaliia pri vysokikh temperaturakh. – S. V. Gorbachev and V. P. Kondrat'ev. *Zhurnal Fizicheskoĭ Khimii*, v. 35, no. 6, June 1961, p. 1235-1239.

g • * Some Observations on the Crystallization of Beryllium Oxide From a **Gaseous Phase** – The growth of **beryllium oxide crystals** from the gaseous phase was observed and studied at 1900, 1800, and even 1600°. Experiments were performed at atmospheric pressure in the Ar-atmosphere. (*In Russian.*) Nekotorye nabliudeniia po kristallizatsii okisi berilliia iz gazovoi fazy. – P. P. Budnikov and N. V. Shishkov. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 5, 1961, p. 1093-1094 + 1 plate.

h • **Purification of Hydrogen** by Permeation Through Palladium and **Palladium Alloys** – Upon introduction of hydrogen alpha-palladium transforms discontinuously to beta-palladium-hydrogen phase which, although it has the same crystal structure, has a specific volume roughly 10% larger than that of alpha-palladium. An alpha-beta boundary forms as hydrogen, enters the material and diffuses into it, and a few cycles of this sort are all that most devices can stand. – Leonard R. Rubin. *Engelhard Industries Technical Bulletin*, v. 2, no. 1, June 1961, p. 8-15.

i • * The Intermetallic Compounds **Cd_4Sb_3** – The Cd-Sb system was studied by the thermal and radiographic methods and by examining its **microstructure, microhardness, conductivity** and **thermoelectromotive force.** The various tests show the existence of a Cd_4Sb_3 compound, analogous to the Zn_4Sb_3 in the Zn-Sb system. (*In Russian.*) Intermetallicheskoe soedinenie Cd_4Sb_3. – Ia. A. Ugaĭ, Iu. Ia. Dolgova, and T. A. Ziubina. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 4, June 1961, p. 856-858 + 1 plate.

j • * On the Structure of **Uranates** – Theoretical discussion based on available literature on the **structure** of uranates. (*In Russian.*) K voprosu o stroenii uranatov. – E. A. Ippolitova and

k •

L. M. Kovba. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 2, May 1961, p. 377-380.

Radiation Chemistry of **Gases** – Presents essential introductory material; the reactions of a single component, oxidation, hydrogenation, nuclear processes, oxides of nitrogen, various parameters, and electric fields. – Samuel C. Lind. 313 pp. Apr. 1961. Reinhold Publishing Corp., New York. (QD601 L64r)

• **Halides** of the **Phosphorus Group Elements** (P, As, Sb, Bi) – D. S. Payne. *Chemical Society, Quarterly Reviews*, v. 15, no. 2, 1961, p. 173-189.

CHEMISTRY—ORGANIC

• Simultaneous **Transformations of Cyclohexane and Thiophenes** Over a Cobalt Oxide-Molybdenum Oxide-Bauxite Catalyst and a Nickel Sulfide Tungsten Sulfide Catalyst – The transformation of cyclohexane into benzol during tests with a cyclohexane-thiophene mixture seems considerably lower than during tests involving pure cyclohexane. On the other hand, transformation of cyclohexane into methyl cyclopentane are much higher in the first case than during tests with pure cyclohexane. The unfavorable effect of desulfurization and the connected formation of hydrogen sulfide on the dehydration of naphthenes into aromates may render difficult a **desulfurizing process** based on the autorefining principle. (*In German.*) Gleichzeitige Umwandlungen von Cyclohexan und Thiophen über einem Kobaltoxyd-Molybdänoxyd-Bauxit-Katalysator und einem Nickelsulfid-Wolframsulfid-Katalysator. – W. J. Hendriks, J. C. Vlugter, H. I. Waterman, and W. J. van de Weerdt. *Brennstoff-Chemie*, v. 42, no. 7, July 1961, p. 215-220.

• **Iron Carbide Phases** in Catalysts for the **Synthesis of Gasoline** – A survey was made of iron carbide variants found **in catalysts** in recent years. During the carburation of a reduced melting contact obtained from magnetite ore, another anomalous carbide phase was observed. This phase resembles closely that of cementite, hence its name: pseudocementite. These data and those concerning the stoichiometric composition and the thermomagnetic properties seem to indicate the possibility that solid solutions develop between the carbide phases mentioned. (*In German.*) Eisencarbidphasen in Benzin-Synthese-Katalysatoren. – O. G. Malan, J. D. Louw, and L. C. Ferreira. *Brennstoff-Chemie*, v. 42, no. 7, July 1961, p. 209-212.

Acetylenic Compounds Related to **Stilboestrol.** IV. The Preparation of **α-Alkyl-β-ethynyl-4,4′-dihydroxystilbenes** – Use of the 1,2-di(*p*-tetrahydropyranyloxyphenyl)-derivative, obtained from 4,4′-bis(tetrahydropyranyloxy)deoxybenzoin and ethynylmagnesium bromide, gave 1,2-di(*p*-hydroxyphenyl)-but-1-en-3-yne. – C. W. Shoppee, J. Cymerman Craig, and Ruth E. Lack. *Chemical Society, Journal*, 1961, June, p. 2291-2298.

Compounds Related to the Steroid Hormones. II. The Action of Hydrogen Bromide on **2-Bromo-3-Oxo-Δ¹-5α-Steroids** – From 2-bromo-5α-cholest-1-en-3-one this reaction has been traced through the 1,2-dibromides to the 1,4-dibromoketone; the 1,2-dibromo-compounds can also be derived from 5α-cholest-1-en-3-one. – G. F. H. Green and A. G. Long. *Chemical Society, Journal*, 1961, June, p. 2532-2543.

• Preparation, Properties, and Spectra of Eight **Alkylated Indenes** – Theodore L. Yarboro, Clarence Karr, Jr., and Patricia A. Estep. *Journal of Chemical and Engineering Data*, v. 6, no. 3, July 1961, p. 421-425.

• **Silicate Esters** and Related Compounds – **Physical properties** of certain tetraalkoxysilanes, polyalkoxypolysiloxanes, bis(trialkoxysilyl)ethanes, bis(trialkoxysiloxy)alkanes, and compounds containing N, P, and halogens. – A. Doyle Abbott, et al. *Journal of Chemical and Engineering Data*, v. 6, no. 3, July 1961, p. 437-442.

• **Imidazole-Dyes.** V. Condensation of **Pyrene Acid** With Aromatic *o*- and *peri*-Diamines – Studies the **condensation reaction** for the production of 1-phenalone-6,7 dicarboxylic acid ("Pyrene" acid) and for its bromaton, and describes the condensation with the *o*- and *peri*-diamines into aroylenimidazole dyes and their halogenation. (*In German.*) Imidazol-Farbstoffe.

V. Kondensation der Pyrensäure mit aromatischen *o*- und *peri*-Diaminen. – J. Arient, J. Dvořák, and V. Štěpánek. *Collection of Czechoslovak Chemical Communications*, v. 26, no. 6, June 1961, p. 1542-1550.

Further Examples of the **Adamantane Rearrangement** – The results demonstrate the generality of the adamantane rearrangement and show that its extensions have preparative utility. – Paul von R. Schleyer and Robert D. Nicholas. *Tetrahedron Letters*, 1961, no. 9, July, p. 305-309.

A New Class of **Local Anesthetics:** Hydroxyalkyliminobisacetamides – A series of **hydroxyalkyliminobisacetamides** and their esters was prepared and examined for local anesthetic action. The compounds derived from *N*-α,α-trimethylphenethylamine showed a high degree of activity, some examples being 4000 times as active as procaine. Structure-activity relationships were studied in the course of this investigation. – Meier E. Freed, William F. Bruce, Roy S. Hanslick, and Albert Mascitti. *Journal of Organic Chemistry*, v. 26, July 1961, p. 2378-2383.

• Photochemical Reaction of **Dyes in Amide Media** – The absorption spectra of methylene blue and azure I in amide media (formamide and polyamide films) shifts in the direction of shorter waves on exposure to visible light. This has been associated with **demethylation** of dye molecules. (*In Russian.*) Fotokhimicheskoe izmenenie krasiteleĭ v amidnykh sredakh. – Kh. L. Arvan and N. V. Ivanova. *Zhurnal Fizicheskoĭ Khimii*, v. 35, no. 6, June 1961, p. 1215-1218.

• Extension of the Total **Synthesis** in the Group of the **Nor-Testosterones** – The total synthesis of different steroids recently determined allows the extension toward homologues alkylated on the nuclease A, or toward isomers of the natural series. As an example, the preparation of 2α-methyl-nor-testosterone and of 19-nor-9β, 10α-testosterone was described. (*In French.*) L'extension de la synthèse totale dans le groupe des nor-testostérones. – Léon Velluz, Gérard Nominé, Robert Bucourt, André Pierdet, and Jean Tessier. *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 252, no. 25, June 19, 1961, p. 3903-3905.

• Formation and Nitrous Deamination of **Amino-5 Trans-Perhydrindanes** – The amino-5 trans-perhydrindanes *a* and *e* are formed from the trans-perhydrindane carboxylic-5 *e* acid and from the trans-perhydrindanol-5 *e* acid. These two amines result also from the hydrogenation of trans-perhydrindanone-oxime-5. The nitrous **deamination** was studied and compared with that of amino-2 trans-decalins. (*In French.*) Formation et désamination nitreuse des amino-5 trans-perhydrindanes. – Robert Granger, Jean-Pierre Girard, and Henri Técher. *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 252, no. 25, June 19, 1961, p. 4009-4010.

• A Contribution to the Study of **Dimethyl-2.8 Phenoxazine** – After determining the composition of this compound, the authors prepared the 2,8-dicarboxylic derivative by **permanganic oxidation** of N-acetylated dimethyl-2,8 phenoxazine in the presence of pyridine and carbon dioxide. (*In French.*) Contribution à l'étude de la diméthyl-2.8 phénoxazine. – René Hazard, Jean Cheymol, Pierre Chabrier, Alès Sekera, and Jacques De Antoni. *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 252, no. 26, June 26, 1961, p. 4166-4167.

• Molecular Compounds of Tin Tetrachloride With Organic Sulphides – In this work an attempt was made to study the **complex formation** processes in the systems **tin tetrachloride--organic sulfides** in benzene by the dielectric polarization method, and the investigation of a series of properties of formed complexes. (*In Russian.*) Molekuliarnye soedineniia chetyrekhkhloristogo olova s organicheskimi sul'fidami. – I. P. Gol'dstein, K. A. Kocheshkov, and E. N. Gur'ianova. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 5, 1961, p. 1099-1102.

• Reaction of **Benzoyl Peroxide** With **Titanocene** Derivatives – (*In Russian.*) Reaktsii perekisi benzoila s proizvodnymi titanotsena. – G. A. Razuvaev, V. N. Latiaeva, and L. I. Vyshinskaia. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 5, 1961, p. 1126-1129.

• High Temperature Interaction of **Triarylsilanes** With Allyl Chloride, Chlorobenzene and *p*-Dichlorobenzene – **Synthesis** was carried out in a quartz tube 20 mm in diam. placed in an electric

furnace. The tube before the beginning of experiment was flushed with N. Products were collected in a trap cooled to −20 C. Past the trap, an absorber filled with 0.1 NaOH was located. The amount of HCl formed was determined after each experiment. (*In Russian.*) Vzaimodeistvie pri vysokikh temperaturakh triarilsilanov s allilkhloridom, khlor- i *n*-dikhlorbenzolami. – E. Fisher and A. D. Petrov. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 1, May-June 1961, p. 136-138.

• Studies in the Field of **Synthesis** and **Transformations** of Unsaturated **Organo-Silicon Compounds.** I. The Esterification of Primary and Tertiary Acetylene Alcohols, Containing γ-Silicon, by Adipinic Acid. II. Cyannoethylation of Tertiary Acetylene Alcohols Containing γ-Silicon – (*In Russian.*) Issledovanie v oblasti sinteza i prevrashchenīĭ nepredel'nykh kremneorganicheskikh soedineniĭ. I. Eterifikatsiia pervichnykh i tretichnykh γ-kremnesoderzhashchikh atsetilenovykh spirtov adipinovoĭ kislotoĭ. II. Tsianetilirovanie tretichnykh γ-kremnesoderzhashchikh atsetilenovykh spirtov. – I. M. F. Shostakovskiĭ, N. V. Komarov, V. P. Kuznetsova, and I. I. Igonina. II. M. F. Shostakovskiĭ, L. M. Kaliberdo, and N. V. Komarov. *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1961, no. 4, Apr., p. 699-705.

• **Demethylation** and Isomeric Conversion of **Pseudocumene** Over Aluminosilicates – Studies the reaction of dealkylation of pseudocumene and of combined alkylation of benzene and toluene in the presence of aluminosilicates. A pressure of 5-10 atm at temperatures between 450 and 480 C starts these reactions. After treating the pseudocumene mixtures one time with toluene the xylene yield is ~30% on the catalyst. (*In Russian.*) Demetilirovanie i izomernoe prevrashchenie psevdokumola nad aliumosilikatami. – G. M. Mamedaliev, A. V. Topchiev, N. D. Vlasova, and G. N. Anikina. *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1961, no. 4, Apr., p. 637-645.

• **β-Sultones Containing Fluorine.** V. The Interaction of Tetrafluoroethane-β-Pyrosultone With Alcohols. VI. Sulfofluoride-Monofluoroacetic Acid – (*In Russian.*) Ftorsoderzashchie β-sul'tony. V. Vzaimodeĭsvie tetraftoretan β-pirosul'tona so spirtami. VI. Sul'foftoridmonoftoruksusnaia kislota. – G. A. Sokol'skii, M. A. Dmitriev, and I. L. Knuniants. *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1961, no. 4, Apr., p. 617-622.

Industrial **Organic Nitrogen Compounds** – The coverage includes all compounds of present and potential commercial significance, except naturally occurring ones. Reactions about which little is known are included to suggest profitable areas for further research. **Reaction mechanisms** appear, when needed, for a thorough understanding of the reactions described. – Melvin J. Astle. 392 pp. 1961. Reinhold Publishing Corp., New York. (QD401 As85i)

Reduction of Aromatic **Nitro-Compounds** by Sodium Borohydride Catalysed by Transition-Metal Complexes – Antonín A. Vlček and Albert Rusina. *Chemical Society, Proceedings*, 1961, May, p. 161-162.

Heterocyclic Systems With **Bridgehead Nitrogen** Atoms – William L. Mosby. v. XV. pt. 2. 1467 pp. 1961. Interscience Publishers, New York. (QD331 C42)

• **Synthesis** of Pyrano [2,3-c] Pyrazol-3-ones. Report 1. **Pyrazoles** – Describes the synthesis of some **γ-halide propyl pyrazolidine-3,5-diones.** Their salts with bases condense easily intramolecularly into hydropyrano [2,3-c] pyrazoline-3-ones where the dihydropyrane ring can be split into corresponding γ hydroxypropyl pyrazolidine-3,5-dione-anion(IV). (*In German.*) Synthese von Pyrano[2,3-c]pyrazol-3-onem. Über Pyrazole. Mitteilung I. – K. Michel and M. Matter. *Helvetica Chimica Acta*, v. 44, no. 4, 1961, p. 1025-1030.

• Investigations of the Formation and Transformation of **Organic Derivatives of Fluorine.** VI. New Fluoric or Nonfluoric Carbamates of Aminoalcohols and of Hydroxylated Quarternized Bases – Some new **diethylcarbamates** of dialkylamino-alcohols of type I (fluorinated or not) have been prepared from diethylcarbamylchloride and the corresponding aminoalcohols. The tertiary amino group of these diethylcarbamates can be quaternized by treatment with an alkylhalide. (*In French.*) Recherches sur la formation et la transformation de dérivés organiques du fluor VI. Nouveaux carbamates d'aminoalcools et de bases quaternaires hydroxylées, fluorés ou non. – Emile Cherbuliez, Br. Baehler, A. Yazgi, and J. Rabinowitz. *Helvetica Chimica Acta*, v. 44, no. 4, 1961, p. 1169-1171.

• Bromination of **Alkylthienylketones** – (*In Russian.*) Bromirovanie alkiltienilketonov. – Iu. B. Vol'kenstein and J. L. Gol'dfarb. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 1, May-June 1961, p. 115-118.

• **Isotope Exchange Reactions** of Hydrogen in Alkyl Halides. II. The Hydrogen Exchange of **Tertiary Alkyl Chlorides** in Anhydrous Acetic Acid in the Presence of Aprotonic Acids. III. The Role of **Aprotonic Acids** in Hydrogen Exchange Reactions of Tertiary Alkyl Chlorides – (*In Russian.*) Reaktsii izotopnogo obmena vodoroda galoidnykh alkilov. II. Vodorodnyĭ obmen tretichnykh khloristykh alkilov v bezvodnoĭ uksusnoĭ kislote v prisutstvii aprotonnykh kislot. III. O roli aprotonnykh kislot v reaktsiiakh vodorodnogo obmena tretichnykh alkilkhloridov. – V. N. Setkina and D. N. Kursanov. *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1961, no. 4, Apr., p. 664-672.

• Technique of Organic Chemistry. I. Investigaton of Rates and **Mechanisms of Reactions** – S. L. Friess, E. S. Lewis, and A. Weissberger, editors. v. VIII. 2nd Ed. 702 pp. 1961. Interscience Publishers, New York. (QD501 F91i2)

• A New Method for the Production of **Polyene Aldehydes** – A new method is described for the **synthesis** of β-C_{18}-aldehyde from β-C_{14}-aldehyde and the acetal of γ-bromotiglic aldehyde. (*In Russian.*) Novyĭ sposob polucheniia polienovykh al'degidov. – S. M. Makin. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 2, May 1961, p. 387-389.

• Addition of Hydrogen Chloride and Acetic Acid to Isomeric **Cyclodecatrienes-1,5,9** – (*In Russian.*) Prisoedinenie khloristago vodoroda i uksusnoi kisloty k izomernym tsiklododekatrienam-1,-5,9. – L. I. Zakharkin, V. V. Korneva, and A. V. Iogansen. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 2, May 1961, p. 373-376.

CHEMISTRY—PHYSICAL (ORGANIC AND INORGANIC)

• **Kinetic Studies** of **Iodine Exchange** Between Hydrogen Iodide and Crystalline Aluminum Iodide Labelled With ^{131}I – All evidence leads to the conclusion that the obtained exchange diagrams are explainable by assuming that the investigated halogen exchange process occurs by two independent paths. A slow exchange characterized, under the conditions used in our experiments, by a mean rate constant $k(S) \cong 5.10^{-7}$ sec^{-1} and a rapid exchange strongly affected by structural factors and showing rates of progress by 2 to 4 orders of magnitudes higher than that of the slow one. The energy of activation was calculated and found within the limits of our experimental accuracy practically the same for both exchange processes, its average numerical value being 3.2±0.2 kcal/mol. – Ignacy Złotowski and Andrzej Polaczek. *Nukleonika*, v. 6, no. 5, 1961, p. 335-354.

• Study of the **Flade Potential** of **Nickel** – The Flade potential in sulphuric acid has been investigated by means of potential-decay curves in function of time in the pH range 0-2. The decay proceeds through 0-3 plateaus depending upon the time during which the anode is held in the passive state. (*In German.*) Zum Flade-Potential des Nickels. – L. F. Trueb, G. Trümpler, and N. Ibl. *Helvetica Chimica Acta*, v. 44, no. 4, 1961, p. 960-968.

• The Influence of the Structure of **Alkylaromatic Hydrocarbons** on the Kinetics of Their Dehydrogenation – The effect of introduction of a 2nd radical in the benzene ring was investigated by means of study of the kinetics of **ethyltoluene dehydrogenation.** (*In Russian.*) Vliianie straeniia alkilaromaticheskikh uglevodorodev na kinetiku ikh dagidrogenizatsii. – O. K. Bogdanova, A. A. Balandin, and I. P. Belomestnykh. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 5, 1961, p. 1089-1092.

• A Contribution to the Real Structure of **CdS Single Crystals** – The angular changes in orientation of the (0110)- and (0001)-planes of 30 CdS laminas grown from the vapor phase were

determined. Different crystals were bent. This bending was attributed to the formation of excessive step displacements of one sign during growth or during the first phase of cooling. Possible effects on conductivity, even when stresses reach the breaking limit, were below 1%. (*In German.*) Zur Realstruktur von CdS-Einkristallen. – W. Möhling and H. Thiel. *Annalen der Physik*, v. 7, nos. 7-8, Mar. 1961, p. 381-386.

• Reactions of **Manganese-Containing Iron** With Its Oxides in the Lime Crucible at 1600 to 1800°C – Studies the contents of the Fe melts and of the slags in the lime crucible, the ternary Fe(II)-oxide-Mn(II)-oxide-lime system and the marginal systems, the **deoxidation of Fe-melts** with Mn in the presence of lime and of lime-saturated protoxide slag, the deoxidation of Fe-melts with Mn and solid lime. (*In German.*) Die Reaktionen von manganhaltigem Eisen mit seinen Oxyden im Kalktiegel bei 1600 bis 1800°C. – Wilhelm Anton Fischer and Hans Joachim Fleischer. *Archiv für das Eisenhüttenwesen*, v. 32, no. 5, May 1961, p. 305-313.

• Processes of Sorption and Ion Exchange on **Amphoteric Oxides and Hydroxides** – Studies the regions of application of amphoteric oxides and hydroxides as **inorganic ion exchangers** and sorbents, the **sorption properties** of different oxides and hydroxides of Fe and Al, Ti dioxide, Zr oxides and hydroxides and ion exchangers based on them, Zn oxides and hydroxides, Sn dioxide hydrate, oxides and hydroxides of some other metals, and special features of the mechanism of the ion exchange on oxides and hydroxides. (*In Russian.*) Zakonomernosti sorbtsii i ionnogo obmena na amfoternykh okisiakh i gidrookisiakh. – G. M. Zhabrova and E. V. Egorov. *Uspekhi Khimii*, v. 30, no. 6, July 1961, p. 764-776.

• **Nickel Complexes** With Nitrile Triacetate – The stability of the complex formed by the Ni ion with NTA^{3-} was studied as a function of the pH of the solution. The Ni ion forms with the **nitrile triacetic** ion the Ni-mononitrile triacetate ($NiNT^-$) complex, stable at pH = 3.5-11, in a solution containing one equivalent of the complexing agent for one equivalent of Ni ion. When the solution contains two equivalents of the complexing agent for one Ni equivalent, the mononitrile acetic complex is stable only at pH 3.5 to 6.5. (*In French.*) Les complexes du nickel avec le nitrilotriacétate. – B. Kirson and R. Bornstein. *Société Chimique de France, Bulletin*, 1961, no. 6, June, p. 1081-1084.

• The **Cobalt Nitrile Triacetate Complexes** – The Co ions (Co^{2+}) form with nitrile triacetic ions a ($HNTA^{2}$) mononitrile triacetate complex with low molecular extinction (24.75) and maximum optical absorption at 510 mμ, stable in the region of pH ≈ 4-8.5. The Co ions form with a sufficient amount of nitrile triacetic ions, at pH ≈ 9, the Co dinitrile triacetate complex $Co(NTA)_2^{4-}$ having a low molecular extinction (16.25) and a stable optical density at 510 mμ at pH ≈ 8-10.5. (*In French.*) Les complexes cobalt-nitrilo-triacétates. – B. Kirson and R. Bornstein. *Société Chimique de France, Bulletin*, 1961, no. 6, June, p. 1101-1105.

• **Aminoalcohols.** XV. **Stereoselective Production** and Configuration of the Diastereomere DL-3-Amino-1.2-Diphenyl-Propanols-(1) (as a Contribution to the Study of the Mechanism of the Ring Terminal Reaction of Aminoalcohols With Benzimide Ester). XVI. A Contribution to the **Alkylation** of Aminoalcohols With Formaline and Formic Acid – (*In German.*) Aminoalkohole. XV. Stereoselektive Darstellung und konfigurative Zuordnung der diastereomeren DL-3-Amino-1.2-diphenyl-propanole-(1) (zum Mechanismus der Ringschlussreaktion von aminoalkoholen mit Benzimidsäureester). XVI. Beitrag zur Alkylierung von Aminoalkoholen mit Formalin und Ameisensäure. – Günther Drefahl and Hans-Heinrich Hörhold. *Chemische Berichte*, v. 94, no. 6, 1961, p. 1641-1664.

• The Electronic Effect on the Intramolecular **Hydrogen Bonding** in α-Aryloxypropionic and α-Aryloxyisobutyric Acids – The stability conditions for *cis* and *trans* intramolecular bonding among **α-aryloxy fatty acids** was investigated. The *cis* orientation is stable unless strong electron-repelling substituents are present. – Michinori Oki and Minoru Hirota. *Spectrochimica Acta*, v. 17, no. 6, June 1961, p. 583-593.

• **Catalytic Hydrogenation** of Polyvalent Metallic Ions. I. Hydrogenation of **Ferric Sulfate** – The catalytic reduction of ferric sulfate was studied in an aqueous medium under low H pressure. The acidity of the medium has much influence and the speed is independent of the concentration of the Fe^{+++} or Fe^{++} ions. The speed is of the order of 1 in relation to the H concentration of the reaction medium and to the amount of catalyst used. (*In French.*) Hydrogénation catalytique des ions métalliques plurivalents. I. Hydrogénation du sulfate ferrique. – Pierre Boutry, Odile Bloch, and Jean-Claude Balaceanu. *Société Chimique de France, Bulletin*, 1961, no. 6, June, p. 1098-1101.

• On the Dense Phases of **He^3** at **Very Low Temperatures** – A class of physical properties of the dense phases of He^3 are dominated at low temperatures by their **nuclear spin systems.** Studies suggest that in order to obtain satisfactory, experimentally inaccessible, extrapolated very low temperature behaviors and finite limits of the above class of properties, careful prior analysis of their finite temperature values will have to be performed in terms of the partial properties of the spin systems as well as those of the degrees of freedom other than spin of the dense phases of He^3. – Louis Goldstein. *Annals of Physics*, v. 14, July 1961, p. 77-93.

• Some Primary α,γ-**Diethylene Alcohols** and Their **Isomerization** Into Dihydro-2.3 α-Pyrans – These primary alcohols were prepared by reducing α,γ-diethylene acid esters by means of double Li and Al hydride. Some of these alcohols are isomerized into **dihydro-2,3 α-pyrans** by heating with aqueous solutions of mercuric sulfate. (*In French.*) Sur quelques alcools primaires α,γ-diéthyléniques et leur isomérisation en dihydro-2,3 α-pyrannes. – Jean Colonge and Jean Varagnat. *Société Chimique de France, Bulletin*, 1961, no. 6, June, p. 1125-1128.

• The **Hydrogen Bond.** IV. Intramolecular Hydrogen Bonding **in Triols** – The free and intramolecularly bonded OH bands were measured in CCl_4 and/or $CHCl_3$ solution for the following compounds: catechol, pyrogallol, pyrogallol-1-methyl ether and 2-methyl ether; propane-1:3 diol; pentane-1:3:5-triol; 1:1:1-trimethylol propane; heptane-1:4:7-triol; heptane-1:4:7-triol-1-methylether and 4-methyl ether. Evidence is presented which shows that in CCl_4 the associated monohydric alcohols are cyclic, whereas in $CHCl_3$ they are acyclic. The Δv of diols and triols is 25 per cent larger in $CHCl_3$ than in CCl_4. – Lester P. Kuhn and Roger E. Bowman. *Spectrochimica Acta*, v. 17, no. 6, June 1961, p. 650-660.

• A Contribution to the Study of the Chemistry of Metal Carbonyls in Liquid Ammonia. VIII. **Dihydrogen-Hexacarbonyl-Diniccolate (-I).** II – The dihydrogen-hexacarbonyl-diniccolate(-I) $H_2Ni_2(CO)_6 \cdot 4NH_3$ producible in liquid ammonia by reduction of $Ni(CO)_4$ with Na, is caused to react with alkalicyanide in the aquo-ammono system and in iodine with liquid ammonia for the purpose of determining the oxidation number of Ni and of the relationship between Ni and the carbon oxide with water. (*In German.*) Zur Kenntnis der Chemie der Metallcarbonyle in flüssigem Ammoniak. VIII. Über Dihydrogen-hexicarbonyl-diniccolat(-I). II. – Helmut Behrens, Hans Zizlsperger, and Rudolf Rauch. *Chemische Berichte*, v. 94, no. 6, 1961, p. 1497-1505.

• A Contribution to the Study of **Macrocyclic Ring Systems.** VII. Production and Properties of **Macrocyclic Tetramines** – Describes the syntheses of a series of macrocyclic tetramines with the help of previously developed cyclization methods. The unusual properties of the 1.5.8.12-tetraaza-cyclotetra-decane obtained this way are explained by the presence of a steric arrangement of H bridges especially favorable. (*In German.*) Zur Kenntnis der makrocyclischen Ringsysteme. VII. Herstellung und Eigenschaften makrocyclischer Tetramine. – Hermann Stetter and Karl-Heinz Mayer. *Chemische Berichte*, v. 94, no. 6, 1961, p. 1410-1416.

• **Raman Spectra** of the **Hexachloropalladate, Hexachloroplatinate** and **Hexabromoplatinate** Ions in Aqueous Solution – Excitation by the helium yellow and red lines. The spectra show differences from those previously reported for species of type XY_6 in which Y is a halogen atom and X an atom of a non-transition element. – L. A. Woodward and J. A. Creighton. *Spectrochimica Acta*, v. 17, no. 6, June 1961, p. 594-599.

• Near-Infrared N–H Bands of **Primary Aromatic Amines** in Chloroform Solution – The effects of solvent on the frequencies and the peak molar absorptivities of the bands vary widely depending on the structure of the compound. These effects are

discussed in terms of Hammett's σ-constants and the **acid dissociation constants** of the amines. – Kermit B. Whetsel. *Spectrochimica Acta*, v. 17, no. 6, June 1961, p. 614-626.

• The Strength of Single Crystals of **Inorganic Salts** Under High Pressure. III. IV – On the optical windows for the pressure-proof chamber of three kinds of alkali halide **single crystals,** the projections to the atmospheric side of the window were measured, and some considerations were described. Also, using Taylor's equation, the values of L for the optical windows of sodium chloride, potassium bromide and lithium fluoride were calculated. – Kazuo Inoue. *Review of Physical Chemistry of Japan*, v. 30, no. 2, 1960, p. 80-91.

• **Hydrogen Bridge Bond** of Oxime – A H bridge bond in CCl_4 in **cyclic oximes** was measured in close infrared within a rather large range of concentration, and was evaluated by different methods. For the interpretation of the tests an approximation of the single two-element or three-element association phases is sufficient. A simple graphic method was devised for this purpose. The tendency to form three-element associates decreases with the increase of the ring size, whereas the two-element association increases correspondingly. (*In German.*) Über die Wasserstoffbrückenbindung der Oxime. – Werner Luck. *Zeitschift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 65, no. 4, June 1961, p. 355-362.

• The Influence of Ion-Pairs of Reaction Mechanism. The **Bromoacetate-Thiosulfate Reaction** – The existence and participation of associated ion-pairs in an ionic reaction mechanism are demonstrated by rate behavior of the bromoacetate-thiosulfate ionic reaction. A mechanism for the ionic reaction in which **ion-pair participation** is involved is described. – G. Corsaro and M. C. Morris. *Electrochemical Society, Journal*, v. 108, July 1961, p. 689-694.

• A Contribution to the **Mechanism of Chemisorption** of Gases **in Oxides** – On the basis of the time curve of the Co absorption in pure NiO and in NiO doped with Li_2O and Ga_2O_3 it must be concluded that the proportion of the pure chemisorption constitutes a small per cent only of the gas absorption. Most of the Co absorption is caused by surface reaction with structural components of the crystal lattice. A similar situation must be assumed in the case of the H_2 absorption of NiO and of the O_2 absorption of ZnO. Hence the possibility of definite errors in a large part of the chemisorption results by surface reaction published in the literature. (*In German.*) Zum Mechanismus der Chemisorption von Gasen an Oxyden. – Karl Hauffe. *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 65, no. 4, June 1961, p. 321-327.

• Determination of Traces of Water **in Hydrocarbons** – Describes an analytical method for the **determination of water** concentration up to 5.10^{-4}% in hydrocarbons, based on the measurement of the turbidity due to the effects of water during the hydrolysis of titanium(IV)-chloride. The apparatus used is described and the statistic treatment of the results is carried out. The method requires only a few minutes and no special equipment to be carried out. (*In German.*) Bestimmung von Wasserspuren in Kohlenwasserstoffen. – M. Kubínová, O. Vilím, and V. Svoboda. *Collection of Czechoslovak Chemical Communications*, v. 26, no. 5, May 1961, p. 1320-1324.

• Sorption of Radioactive Isotopes on Precipitates. V. **Sorption of Radioruthenium** on Mercury(II)-Sulfide – Studies the sorption of nitrosylruthenium ions $RuNo^{3+}$ **on mercury(II)-sulfide** formed by the decomposition of sodium thiomercurate. The effects of the hydrogen concentration, of the constituent ratio in the reaction mixture, of temperature, of the duration of the reaction were investigated and a probable explanation of the reaction mechanism was proposed. (*In German.*) Sorption radioaktiver Isotopen an Niederschlägen. V. Sorption des Radioruthens am Queckilber(II)-sulfid. – C. Konečný and D. M. Wagnerová. *Collection of Czechoslovak Chemical Communications*, v. 26, no. 5, May 1961, p. 1325-1331.

Comments on the Theories of **Isothermal Multi-Component Diffusion** – The interrelation between the dynamical theory of isothermal multi-component diffusion and the theory based on irresversible thermodynamics is discussed in some detail. – Stig Ljunggren. *Kungliga Tekniska Högskolans Handlingar*, no. 172, 1961, 31 pp. (T4 K96t Vis.)

a • **Oxidation of Rhodanides** by means of Persulfates in Aqueous Solution – Studies the type of reaction between **persulfates** and rhodanides, determines the stoichiometric equation and the speed of reaction under different conditions of composition, the ion strength of the solution, the pH, the temperature and the impurities. A mechanism of reaction is proposed on the basis of the results. (*In German.*) Oxydation von Rhodaniden mittels Persulfaten in wässriger Lösung. – J. Balej and J. Vondrák. *Collection of Czechoslovak Chemical Communications*, v. 26, no. 5, May 1961, p. 1251-1261.

b • Operational Experiments During the **Decarbonization of Water** With Slightly Acid Hydrogen Exchangers – In the regeneration of slightly acid H exchangers, only low amounts of acid must be used. If excess is used, the exchange efficiency is lowered. Free mineral acid appears in the outflow and the wash water requirement increases considerably. Due to elevated acid amount groups capable of exchange are activated to such extent that they are imparted a considerable capacity for neutral salt decomposition. (*In German.*) Betriebserfahrungen bei der Entkarbonisierung von Wasser mit schwachsauren Wasserstoffaustauschern. – H. Reichelt. *Chemiker-Zeitung/Chemische Apparatur*, v. 85, no. 12, June 20, 1961, p. 443-446.

c • Radiation Processing. Report No. 3. **Gamma Irradiation** of Gaseous CO_2 – The cobalt-60 gamma irradiation **of CO_2** over a range of pressure, temperature and inhibitor concentration in a static system was investigated. – M. Steinburg. *U. S. Atomic Energy Commission, BNL*-665(T-219), Mar. 1961, 11 pp. (UF767 Un3.1bn Contin.)

d • **Neutron Cross Section** Evaluation Group. Newsletter No. 4 – Rudolph Sher and Sophie Moore. *U.S. Atomic Energy Commission, BNL* 672(N-4), May 1961, 7 pp. (UF767 Un3.1bn Contin.)

e • International Series of Monographs on Radiation Effects in Materials. II. **Radiation Chemistry** of Organic Compounds – Describes the chemical changes produced in **organic compounds** by high-energy radiation emphasizing what is known, rather than what is not known. Reviews all original work published in this field since 1895, in the English, French, German, Russian, and Italian languages. – A. J. Swallow. 380 pp. 1960. Pergamon Press, New York. (QD601 Sw18r)

f • The Effect of Co^{60} γ-Rays on the **Isotopic Exchange** Between Hydrocarbon Polymers and Gaseous Deuterium – The action of pure γ-radiation of Co^{60} resulting in an isotopic exchange between **gaseous deuterium** and **polyethylene** and **methylmetacrylate** as well as with certain liquid hydrocarbons. (*In Russian.*) Deistvie γ-izlucheniia Co^{60} na izotopnyi obmen mezhdy uglevodorodnymi polimerami i gazoobraznym deiteriem. – Z. S. Bulanovskaia, M. Varshavskii, V. L. Karpov, and I. J. Petrov. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 1, May-June 1961, p. 146-148.

g • Equilibrium Conditions in the **Co - O and Co - O - H Systems** – The **equilibrium** of the system $Co_3O_4 \rightleftarrows 3CoO + 1/2\ O_2$ was studied by the dissociation of Co_3O_4 as well as by the oxidation of CoO. Equation for the equilibrium pressures of Co_2 was described by the equation obtained from the experimental data. (*In Russian.*) Ravnovesnye usloviia v systemakh Co - O i Co - O - H. – V. F. Balakirev and G. I. Chufarov. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 1, May-June 1961, p. 112-114.

h • The **Radiochemistry of Titanium** – One of a series of monographs on radiochemistry of the elements. Includes a review of the nuclear and chemical features of particular interest to the radiochemist, a discussion of problems of dissolution of a sample, and counting techniques. – Chong Kuk Kim. 23 pp. Mar. 1961. National Academy of Sciences, National Research Council, Washington, D.C. (QD601 N21.6tn)

i • **Oxidation of Cetane** at High Temperatures – Studies the vapor-phase oxidation of cetane between 300 and 400 C, and the properties of high-molecular acids formed under these conditions. Cetane was oxidized in the liquid phase between 170 and 280 C. The acid number of the oxy acids was found to depend on the type of checker work. (*In Russian.*) Okislenie tsetana pri vysokikh temperaturakh. – K. A. Chervinskiĭ and A. M. Orinianskiĭ. *Khimiia i Tekhnologiia, Toplivi Masel*, v. 6, no. 6, June 1961, p. 15-16.

j

k

• **Thermal Diagram** of the Solid State of the **Ternary System Consisting of (Na, K, Cl, Br)** – Using X-ray diffraction exclusively (Debye Scherrer method), the author determined the complete thermal diagram in the solid state of this system. The diagram serves to define the varying composition of the A_1 and A_2 phases in equilibrium (solid solutions Na, K, Cl, Br) at any temperatures. The equimolecular reaction NaCl+Br leads to complete equilibrium whereas the inverse reaction NaBr+KCl stops at a metastable state which in dry atmosphere seems to continue indefinitely. (*In French.*) Diagramme thermique de l'état solide du système ternaire constitué par (Na, K, Cl, Br.). – Nguyen-Ba-Chanh. *Journal de Chimie Physique*, v. 58, May 1961, p. 500-505.

• **Ionization of Argon** by Oxygen and Nitrogen Ions – Measures the total cross-sections of ionization, the total cross sections of electron capture, and the cross sections of formation of secondary ions of argon for the ions N^+, O^+, N_2^+, O_2^+, NO^+, and NO_2^+, with an energy of 15 to 180 kev. The total cross section of ionization and the cross section of formation of double, triple and quadruple charged ions of argon increase with increase of the number of atoms entering in the composition of the primary ion. A link was found between the process of capture of two electrons, leading to the passage $O^+ \rightarrow O^-$ and the formation of multiply-charged ions. (*In Russian.*) Ionizatsiia argona ionami kisloroda i azota. – R. N. Il'in and E. S. Solov'ev. *Zhurnal Tekhnicheskoĭ Fiziki*, v. 31, no. 6, June 1961, p. 680-687.

• Effects of the **High Purity of Iron** on Its **Proton Charge Capacity** (Cathodic Hydrogen) and on Its Brittleness at a Low Temperature – The part played by the defects in Fe in the absorption of the protons was revealed by comparing the capacity for the cathodic charge of Fe samples of different purities, by studying samples of one and the same metal passing different structural states, and by examining the mechanical properties. (*In French.*) Influence de la haute pureté du fer sur son aptitude au chargement en protons (hydrogène cathodique) et sur sa fragilité a basse température. – Simone Besnard. *Annales de Chimie*, v. 6, Mar.-Apr. 1961, p. 245-283 + 9 plates.

• Compared Reactivities of the α or γ Methylated Heterocyclic Quarternary Salts by the Kinetic Study of the Formation of **Styryl Colorants** – The condensation of paradimethylaminobenzaldehyde with the quarternary salts of different heterocycles with reactive methyl groups leading to styryl derivatives is a reaction of the second order. The measure of the speed constants made possible a comparison of the reactivity of the methyl groups, which depends on the reactivity of the heterocycle and on that of the anion. (*In French.*) Réactivitiés comparées des sels quarternaires hétérocycliques α ou γ méthylés par l'étude cinétique de la formation de colorants styryliques. – Pierre Mastagli, Henri Larivé, and Pierre Étevenon. *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 252, no. 24, June 12, 1961, p. 3782-3784.

• Rate Constant and **Mechanism of Interaction** Between Oxygen Atoms and **Methanol** – The main C-containing product of reaction is formaldehyde formed in the primary phase of reaction of the atoms of **oxygen** and alcohol. The absolute values of the rate constant of the reaction of the O atoms with methyl alcohol were measured at temperatures between 347 and 506 K and at pressures of 2 to 14 mm. The energy of activation of the reaction was determined. (*In Russian.*) Konstanta skorosti i mekhanizm vzaimodeĭstviia atomov kisloroda s metilovym spirtom. – L. I. Avramenko, R. V. Kolesnikova, and N. L. Kuznetsova. *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1961, no. 4, Apr., p. 599-603.

• Kinetics of **Dehydrogenation and Dehydration of Alcohols** and of **Dehydrogenation of Hydrocarbons** on WS_2 and MoS_2 Catalysts – On sulfuric **WS_2 and MoS_2** catalysts, the reactions mentioned occur with partial cracking. The energies of activation of these reactions were determined. MoS_2 is much more active than WS_2 for the dehydrogenation of isopropyl alcohol. Only dehydration is obtained on WS_2, but dehydrogenation and dehydration take place on MoS_2. (*In Russian.*) Kinetika degidrogenizatsii i degidratatsii spirtov i degidrogenizatsii uglevodorodov na katalizatorakh WS_2 i MoS_2. – A. A. Tolstopiatova, A. A. Balandin, V. Kh. Matiushenko, and Iu. I. Petrov. *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1961, no. 4, Apr., p. 583-590.

a • Effects of Radioactive Irradiation of a Solid Body on Its Catalytic **Properties** – Studies the action of **radioactive catalysts,** such as sulfate of Mg and Na and Ca chlorides containing β-emitters S^{35} and Ca^{45}, on the reaction of dehydration of cyclohexanol. The catalytic activity decreases in proportion as the radioactivity of the catalyst decreases as a consequence of the decay of radioactive S^{35} and Ca^{45}. (*In Russian.*) O vlianii radioaktivnogo izlucheniia tverdogo tela na ego kataliticheskie svoĭstva. – A. A. Balandin, et al. *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1961, no. 4, Apr., p. 565-571.

b •

c • Adsorption of Ethylene Mixtures and Carbon Dioxide on **Carbon Black** – The **adsorption isotherms of ethylene and CO_2** were measured at 15 and 25 C on carbon black calcined at 3000 C, as well as the isotherms of adsorption of the mixtures of these gases at 25 C. (*In Russian.*) Adsorbtsiia smesei etilena i dvuokisi ugleroda na sazhe. – B. P. Bering, O. A. Likhacheva, and V. V. Serpinskiĭ. *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1961, no. 4, Apr., p. 551-559.

d • Alkylation of Normal **Paraffins** by Olefins at High Temperatures and Pressures – Studies the **alkylation** of paraffin hydrocarbons (C_3-C_6) **by olefins** (C_2-C_4). On a Ca sulfate as on Al oxide, alkylation can occur thermocatalytically. The first olefin molecule combines with the secondary C atom of n-paraffin or with the ternary C atom of isoparaffin. The second molecule of olefin combines only with the primary C atom forming isoparaffin. (*In Russian.*) Alkilirovanie normal'nykh parafinov olefinami pri vysokikh temperaturakh i davleniiakh. – L. Kh. Freidlin, N. M. Nazarova, and A. I. Paliĭ. *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1961, no. 4, Apr., p. 714-721.

e •

f • **Photochemical Reduction** of Ferric Chloride in Aromatic Hydrocarbons – From data obtained on the photochemical reduction of **$FeCl_3$,** it follows that the **chlorination** of **aromatic hydrocarbons** can be intensified by the action of light. (*In Russian.*) O fotokhimicheskom vosstanovlenii khornogo zheliza v aromaticheskikh uglevodorodakh. – A. I. Kriukov and B. J. Dain. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 1, May-June 1961, p. 153-155.

• The **Radiochemistry of Antimony** – William J. Maeck. 54 pp. Feb. 1961. National Academy of Sciences, National Research Council, Washington, D. C. (QD601 N21.6an)

g The **Radiochemistry of Cesium** – One of a series of monographs on radiochemistry of the elements. Includes a review of the nuclear and chemical features of particular interest to the radiochemist, a discussion of problems of dissolution of a sample, and counting techniques. – H. L. Finston and M. T. Kinsley. 68 pp. Feb. 1961. National Academy of Sciences, National Research Council, Washington, D. C. (QD601 N21.6ce)

h • Present State and Perspectives of Development of **Coordination Chemistry** – Studies the increase in the application of coordination chemistry, the increase of the quantitative parameters used in it, the problem of the reciprocal influence of the coordination groups, the tendencies still existing of classical coordination chemistry. (*In Russian.*) Sovremennoe sostoianie i perspektivy razvitiia koordinatsionnoĭ khimii. – A. A. Grinberg. *Uspekhi Khimii*, v. 30, no. 6, July 1961, p. 755-763.

i •

• **Cyclic Acetylenes** and Their Reactions – Studies polymethylene cycles and aromatic compounds with one acetylene bond, cyclic acetylenes with some multiple bonds, heterocyclic compounds with one acetylene bond and the stereochemistry of cyclic acetylenes. (*In Russian.*) Tsiklicheskie atsetileny i ikh reaktsii. – R. Kolinskiĭ. *Uspekhi Khimii*, v. 30, no. 6, July 1961, p. 701-740.

j •

• Separation of **Silicon Isotopes** by Monosilane Rectification – (*In Russian.*) O razdelenii izotopov kremniia rektifikatsiei monosilana. – G. G. Deviiatykh, G. K. Borisov, and A. M. Pavlov. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 2, May 1961, p. 402-404.

k •

• On the **Theory of Solutions.** XI. Effect of Fluctuations on the **Dielectric Constant, Permeability and Electroconductivity of Solutions** – The previously developed theory correlating the di-

electric constant of solutions and the concentration fluctuation has been generalized. The case has been considered when deviations from the Gaussian distribution of fluctuation probabilities may take place in small volume elements. Formulas have been derived, permitting calculation of the difference between the mean local and mean macroscopic values for the dielectric constant from known values of the dielectric constant and index of refraction (beyond the region of adsorption). Formulas have also been derived allowing the differences between the mean local and mean macroscopic electroconductivities (resistances) and mean local and mean macroscopic dielectric constants to be calculated. (*In Russian.*) Kteorii rastvorov. XI. O vliianii fluktuatsii na dielektricheskuiu proivitsaemost, magnitnuiu proivitsaemost i elektro-povodnuct rastvorov. – M. I. Shakhparonov. *Zhurnal Prikladnoĭ Khimii*, v. 35, no. 5, May 1961, p. 977-983.

* Investigation of the **Mechanism of Oxidation,** Hydrogenation and Electrochemical Combustion **on Solid Catalysts.** II. The Catalytic Activity of Surface "Oxides" on **Carbon** – The low temperature oxidation of SO_2 on activated wood carbon has been investigated. The final product or intermediate surface compound of the heterogeneous catalytic reaction was found to be SO_3. This product was found to remain on the carbon surface at low temperatures (20°) and to partially desorb on increasing the temperature and time of desorption, the compound entering the gas phase being SO_2. Formation of the SO_2 oxidation product takes place on carbon in the absence of water. The part played by water is to wash off the SO_3, forming H_2SO_4 and liberating the active centers. The amount of H_2SO_4 increases with the amount of water until formaton of a monomolecular layer on the carbon surface. The surface "oxides" participating in the catalytic oxidation were found to form easily at 20° and to be in equilibrium with the oxygen of the gaseous phase. They are easily removed by evacuation at 20°. All other "oxides" do not participate in the catalytic process. It has been found possible to determine the active centers on the carbon surface by means of the low temperature oxidation of SO_2. (*In Russian.*) Issledovanie mekhanizma okisleniia, gidrirovaniia i elektrokhimicheskago goreniia na tverdykh katalizatorakh. II. O katalicheskoi sposobnosti poverkhnostnykh "okislov" na ugle. –O. K. Davtyan and Yu. A. Tkach. *Zhurnal Prikladnoĭ Khimii*, v. 35, no. 5, May 1961, p. 992-998.

* Investigation of the Reaction of **Hydrazine Formation** During **Ammonia Dissociation** in the Glow Discharge – The experiments have shown that under the most favorable conditions the yield of hydrazine may attain a value of 4% per weight of the amount of ammonia decomposed or 0.5% of the total amount of ammonia. The influence of the discharge energy, or the inflow rate and pressure of the gas and of the trap temperature on the yield has been studied. The yield of hydrazine has been shown to increase with increase in discharge energy, tending towards a limit, the value of which is determined by the rate of flow and pressure of the gas. The yield passes through a maximum with increased inflow rate and pressure. (*In Russian.*) Izuchenii reaktsii obrazovaniia gidrazina pri dissotsiatsii ammiaka v tleivshchem elektricheskom razriade. – I. I. Skorokhodov, L. I. Nekrasov, N. I. Kobozev, and A .D. Filonova. *Zhurnal Prikladnoĭ Khimii*, v. 35, no. 5, May 1961, p. 1026-1030.

* Mechanism of **Liquid Ozone** Decomposition – The quantum yield of the **photochemical decomposition** of ozone in the absence of contact between the decomposing molecules and the walls is not more than 2 at –183°. Packing increases the quantum yield. A **mechanism of the reaction** has been suggested in which the changes in the elementary stages, depending upon the conditions (temperature, presence of solid surface), have been accounted for. The rate and quantum yield of the reaction in relation to the light intensity and temperature have been determined. The correlations obtained have been shown to agree with the proposed mechanism. (*In Russian.*) K voprosu o mekldanizme reaktsii razlozheniia zhidkogo ozona. – A. V. Pankratov and L. A. Bobrysheva. *Zhurnal Prikladnoĭ Khimii*, v. 35, no. 5, May 1961, p. 969-973.

* **Selective Sorption** of **Porous Glass** – The appearance of very thin channels of molecular dimensions in alkali silicate glass treated with acid solutions is due to the extraction of the alkali cations in the cavities of the silicon oxygen lattice. (*In Russian.*) Selektivnaia sorbtsiia na poristykh steklakh. – S. P. Zhdanov and E. V. Koromal'di. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 4, June 1961, p. 870-873.

* Adsorption and **Ion-Exchange Properties** of Silica Modified by a Radical With Acid Functions – By modifying silica gels by **organic radicals** with acid or basic functions, it is possible to obtain specific adsorbents and catalysts. Sulfosilica gels especially can be obtained as nonswelling ion exchangers in highly acid media. Owing to the fact that the framework of such ion exchangers is a thermoresistant **silica gel,** they can operate at higher temperatures than that at which the frame of usual synthetic ion exchanging resins is destroyed. (*In Russian.*) Adosrbtsionnye i ionoobmennye svoĭstva kremnezemov, modifitsirovannykh radikalom s kislymi funktsiiami. – I. E. Neimark and V. M. Chertov. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 4, June 1961, p. 877-879.

* Silicates of Rare Earths. II. The State Diagram of the **Binary Cd_2O_3-SiO_2 System.** III. The State Diagram of the **Binary System Y_2O_3-SiO_2** – (*In Russian.*) Silikaty redkozemel'nykh elementov. II. Diagramma sostoianiia dvoinoĭ sistemy okis' gadoliniia-kremnezem. III. Diagramma sostoianiia dvoinoĭ sistemy okis' ittriia-kremnezem. – II. N. A. Toropov, F. Ia. Galakhov, and S. F. Konovalova. III. N. A. Toropov and I. A. Bondar'. *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1961, no. 4, Apr., p. 539-550 + 2 plates.

* The Crystal Structure of the **Anhydrous Chromium(II) Chloride – Crystal structure** was determined by the X-rays powder method. $CrCl_2$ has an orthorhombic elementary cell with $a = 6.624 \pm 0.006$ Å, $b = 5.974 \pm 0.006$ Å, $c = 3.488 \pm 0.004$ Å, space group D_{2h}^{12}-*Pnnm*. The values for the only free parameters x_{Cl} and y_{Cl} have been refined by a least squares treatment. The structure of $CrCl_2$ is related to the $PdCl_2$ structure and, as expected from the crystal field theory, to the structure of $CuCl_2$. (*In German.*) Die Kristallstruktur des wasserfreien Chrom(II)-chlorides. – H. R. Oswald. *Helvetica Chimica Acta*, v. 44, no. 4, 1961, p. 1049-1054.

* **Steroid Derivatives.** XII. Chromatography of Neutral Steroids on a Thin Aluminum Layer – The method described is rapid (developing in 10 to 20 minutes), has a considerable separation capacity, and is simple for the detection of the optimum carrier on the basis of an abridged eluotropic series. The conditions for the **chromatography** of substances with steroid structure with one to five function groups were found, and the effects of different substituents on the total adsorptivity of the steroid molecule were discussed. (*In German.*) Steroidderivate. XII. Chromatographie neutraler steroide an einer dünnen Aluminiumoxydschicht. – S. Heřmánek, V. Schwarz, and Z. Čekan. *Collection of Czechoslovak Chemical Communications*, v. 26, no. 6, June 1961, p. 1669-1679.

* **Organosilicon Compounds.** XXV. Effects of the Structure on the Velocity of Oxidation of the **Methyl Phenyl Silanes** – Studies the rate of **selective oxidation** of the methyl group in methyl phenyl silanes and in some of their carbon analogs in the gas phase at 380-470 C. The activation energy of oxidation in all the Si and nonsilicon compounds tested exhibits the same value, 81 kcal/mol. The reaction is not really influenced by the effect of induction of the organic substitutes of the central atoms. (*In German.*) Organosiliciumverbindungen. XXV. Einfluss der Struktur auf die Oxydationsgeschwindigkeit der Methylphenylsilane. – J. Beneš, V. Chvalovský, and Bažant. *Collection of Czechoslovak Chemical Communications*, v. 26, no. 6, June 1961, p. 1617-1626.

* Color and **Constitution** of the Isoalloxazin-Silver Complexes. Study of the Behavior of **Riboflavin** in the Presence of **Metal Ions** II – The strong bathochromic shift of the flavin spectra occurring by interaction with $Ag+$ can also be obtained with $Cu+$ and $Hg+^2$, but not with any other metal ions. Two kinds of metal-isoalloxazin-interaction must be discerned, a loose one with the free ligand and a very strong one with the ligand anion. (*In German.*) Farbe und Konstitution der Isoalloxazin-Silber-Komplexe. Zum Verhalten des Riboflavins gegen Metallionen II. – P. Bamberg and P. Hemmerich. *Helvetica Chimica Acta*, v. 44, no. 4, 1961, p. 1001-1011.

* Reactions With ^{15}N. XXXVI. **Constitution** and Decomposition of **Nitramide $O_2N.{}^{15}NH_2$** – ^{15}Traced nitramide was obtained and decomposed by potash lye. The isotope composition of the dinitrogen oxide ^{15}NNO shows that only a nonsymmetric constitution such as $NO_2.{}^{15}NH_2$ or $HO.ON = {}^{15}NH$ can exist, and not the symmetric configuration discussed for a long time in

literature. (*In German.*) Reaktionen mit ^{15}N. XXXVI. Konstitution und Zerfall des Nitramids $O_2N.^{15}NH_2$. – K. Clusius. *Helvetica Chimica Acta*, v. 44, no. 4, 1961, p. 1149-1152.

• Study of the Structure of **Adenosine Triphosphate Complexes** of Bivalent Cations. Hydration of the Central Ion – The **stability constants** of the complexes between ATP and the metal ions Mn^{2+}, Co^{2+}, Ni^{2+} Zn^{2+} have been discussed in terms of **ion pair formation.** (*In German.*) Zur Struktur der ATP-Komplexe zweiwertiger Kationen Hydratisierung des Zentralions. – H. Brintzinger. *Helvetica Chimica Acta*, v. 44, no. 4, 1961, p. 935-939.

COATINGS

• **Blistering** of Painted Steel. I – Film deterioration of **coated panels** is traced to the formation of H developed during corrosion of the bare metal surface. – J. A. W. Van Laar. *Paint and Varnish Production*, v. 51, no. 8, July 1961, p. 31 + 7 pages.

Self-Extinguishing **Urethane Foams** – A new series of **self-extinguishing** rigid urethane foams is intended primarily for low temperature thermal insulation. – *Materials in Design Engineering*, v. 54, no. 1, July 1961, p. 10-11.

Polymethylene Polyphenols. Preparation, Resins, and Varnishes – Internal plasticization of phenolic systems is used to improve flexibility and resilience. This is accomplished by the reaction of long chain C_{25} paraffin wax with phenol by chlorination of the wax and alkylation of phenol with the chlorowax. The waxphenol formed is methylolated with formaldehyde. – William R. Brookes. *Industrial and Engineering Chemistry*, v. 53, July 1961, p. 570-572.

• **Rheology**--Its Influence on the Manufacture and Application **of Paints** – Herbert Bruss. *Paint and Varnish Production*, v. 51, no. 8, July 1961, p. 43 + 5 pages.

• Deep Freeze Extends Pot Life of **Internal Sealant** – To seal joints of a **concrete-lined pipe line,** the contractor used quick-frozen plastic material. – *Pipe Line Industry*, v. 15, July 1961, p. 54.

• Color of **Chromated Zinc Surfaces** – Far more shades are obtained by **coloring** chromating layers on Zn or by coloring anodically oxidized Al than by the usual inorganic coloring methods, although these permit economy of time and installation. As color bases, shiny transparent yellow to brown, grey or olive-green chromate ions are used. Different processes for galvanically extracted Zn and Zn pressure castings are given. (*In German.*) Die Färbung chromatierter Zinkoberflächen. – G. Woldt. *Metall*, v. 15, June 1961, p. 562-565.

System for Describing Visual Appearance – A **representation of color** by hue, brightness, and other properties by use of charts and diagrams. – *American Paint Journal*, v. 45, July 10, 1961, p. 94 + 4 pages.

New **Butadiene-Styrene Resins** Offer Interesting Possibilities –A discussion of properties and uses. – George W. Miller. *American Paint Journal*, v. 45, July 10, 1961, p. 86 + 3 pages.

Tungsten Fabrication by Arc Spraying – Concerns the development of the **plasma-arc spray process** for the fabrication of free-standing W bodies and its projection from the laboratory into the production of full-scale hardware. – R. H. Singleton, E. L. Bolin, and F. W. Carl. *Journal of Metals*, v. 13, July 1961, p. 483-486.

Process Variables in **Plasma-Jet Spraying** – The introduction of commercial plasma-jet equipment has rapidly advanced the technology of spray coating. Briefly reviews some of the experimental data collected during several past investigations to stimulate further experimental and theoretical work in this field. – D. R. Mash, N. E. Weare, and D. L. Walker. *Journal of Metals*, v. 13, July 1961, p. 473-478.

Plasma Spraying Techniques for Toxic and Oxidizable Materials – Two categories of materials are discussed. – A. R. Stetson and C. A. Hauck. *Journal of Metals*, v. 13, July 1961, p. 479-482.

Spotlight Finishing Progress. Effect of Organic Compounds on **Metal Fatigue** – Concludes that long-chain polar substances **increase** fatigue strength. – *Products Finishing*, v. 25, no. 10, July 1961, p. 78 + 2 pages. a

Testing Paint Films: **Automatic Sprayer** Produces Uniformly • Painted Panels – Eric H. Cocks. *Products Finishing*, v. 25, no. 10, July 1961, p. 50-52.

• **Immersion Plating** of the Platinum Group Metals – Satisfactory immersion plating processes have been developed for the deposition of **palladium, rhodium, ruthenium,** and **platinum** up to thicknesses of 50, 30, 100, and 65μ in., respectively. – R. W. Johnson. *Electrochemical Society, Journal*, v. 108, July 1961, p. 632-635. b •

• **Oil-Modified Urethanes** in Industrial and Maintenance Finishes – J. M. Stanton and D. M. Roholt. *Paint Industry Magazine*, v. 76, July 1961, p. 7-11. c

• **Hard Surfacing** Cam Shafts Hikes **Wear Life** – Shafts in a • truck brake cam mechanism are lasting four times as long as new parts of hardened SAE 1040 steel. – *Western Metalworking*, v. 19, July 1961, p. 41.

d

Our new format should help you scan the page quickly. Boldface clue words identify subject matter. Titles appear unchanged at the beginning of each abstract.

• Economics of **Wood Finishes, Laminates, and Veneers** – Compares **cost** of veneering and finishing against the alternative of melamine laminations, which have made a substantial entry into • this field in recent years. – B. M. Letsky. *Product Finishing*, v. 14, July 1961, p. 57-64. e

• Determination of **Cobalt, Zinc, Manganese** and **Lead** Found in Mixed Driers – **EDTA complexometric titration** in benzene solution diluted with methanol. – Alvin Graske. *Official Digest*, v. 33, July 1961, p. 855-860. f

• **Polyesters** for Surface Coatings – Covers adaptation of unsaturated polyester resins to **surface coating** applications, includes a discussion of the mechanisms whereby these polymers can be employed for this type end use. – John G. Weinmann. *Official Digest*, v. 33, July 1961, p. 842-854. g •

• **Emulsion Paints** on Wood – Reviews exposure results from latex paint systems over **wood** surfaces. – Wesley G. Vannoy. *Official Digest*, v. 33, July 1961, p. 807-829. •

Aluminum Nitride Containers for **Vacuum Evaporation of Aluminum** – From experimental data, it can be concluded that aluminum nitride possesses the essential requirements of a container material in the Al vacuum metallizing process. The refractory appears to have long life expectancy which should be • attractive for continuous metallizing processes requiring large amounts of metal. – George Long and L. M. Foster. *American Ceramic Society Bulletin*, v. 40, July 1961, p. 423-425. h

• **Coatings:** a Tougher, Brighter Future – Developments in **vinyls, acrylics, urethanes,** and **silicones** provide paints easier to put on, harder to wear off, with colors that will stay brighter for longer. – *Canadian Chemical Processing*, v. 45, July 1961, • p. 40-42. i

How to Get the Most From **Phosphating** Systems. I – Recommended **practices** for zinc phosphate dip baths. – George H. Pimbley. *Metal Progress*, v. 80, no. 2, Aug. 1961, p. 103 + 8 pages. j

Daylight Fluorescent **Pigments** – Discusses the phenomenon • of fluorescence in paints, spectroscopy of fluorescent colors, and the development of various **fluorescent** pigments. – Robert W. Voedisch. *American Paint Journal*, v. 45, Aug. 7, 1961, p. 72 + 10 pages.

A **One-Coat** White Process for **Vitreous Enamelling** – Gives details of treatment sequences. – *Industrial Finishing (London)*, v. 13, July 1961, p. 50-51. k

CONTROL SYSTEMS, COMPUTERS, AUTOMATION, CYBERNETICS, AND SYSTEMS ENGINEERING

* Some Cases of Similarity of **Transient Processes** in One-Loop **Nonlinear** Automatic **Control** Systems – Theoretical analysis of systems under consideration. (*In Russian.*) Nekotorye sluchai podobiia perekhodnykh protsessov v odnokonturnykh nelineinykh sistemakh regulirovaniia. – V. T. Dedesh. *Avtomatika i Telemekhanika*, v. 22, no. 6, June 1961, p. 801-802.

* Comparative Investigation of **Cybernetic Systems** Differing in Extremum Search Strategy – The potential possibilities of four types of **sampled-data extremum systems** (each with four variations of the law of change of the manipulated variable) are compared, employing the methods of S. Chang and R. Van Nice. Greater simplifications are assumed (the approximation of the extremum characteristics by straight lines, a new approach in minimum error estimation, etc). (*In Russian.*) Sravnenie kiberneticheskikh ekstremal'nykh impul'snykh sistem, otlichaiushchikhsia strategieĭ poiska ekstremuma. – A. G. Ivakhnenko. *Avtomatyka*, 1961, no. 3, p. 27-29.

* Time Quantization Error in **Automatic Control** – The technique for the determination of required frequency of parameter measuring in automatic discrete control is considered. A possible way of reducing the **time quantization error** is described. (*In Russian.*) Pogreshnost vremennogo kvantovaniia pri avtomaticheskom kontrol. – S. M. Mandel'shtam. *Avtomatika i Telemekhanika*, v. 22, no. 6, June 1961, p. 780-786.

* **ALGOL** Employed – Georgia Tech's use of compiler triples **programming speed.** – *Data Processing*, v. 3, June 1961, p. 32-34.

Studies in the Asymptotic **Theory of Control Systems.** II – Concerns the asymptotic properties of a certain class of control systems from three points of view: the deterministic, the stochastic, and the adaptive. – D. S. Adorno. *California Institute of Technology, Jet Propulsion Laboratory, Technical Report No. 32-99*, June 1, 1961, 42 pp. (TL501 C12.4t Contin.)

* Solution of the von Mises **Boundary Layer Equation** Using a **High-Speed Computer** – In the problem of incompressible boundary layer flow along a semi-infinite flat plate against an adverse pressure gradient, the non-dimensional free stream velocity is taken to be $u_1 = 1\text{-}x$ where the plate lies along the positive part of the x-axis. – A. R. Mitchell. Mathematics of Computation, v. 15, no. 75, July 1961, p. 238-242.

* A Simple **Experimental Computer** With **Negative Basis** – The technical data, logic, and control organization of a simple experimental computer operating in the minus-two system. The principles for composing the instructions from elementary operations, the characteristics of minus-two computer arithmetic, and the logic of the arithmetic unit are briefly explained. – A. Łazarkiewicz and W. Balasiński. *Mathematics of Computation*, v. 15, no. 75, July 1961, p. 275-285.

* **Computer** Helps Physicians **Diagnose** – Space technology extends health frontiers. – *Data Processing*, v. 3, June 1961, p. 21-23.

* The State of **Digital Computer Technology** in Europe – Indicates the level of computer development and application in each of the 30 countries of **Europe,** most of which were recently visited. – Nelson M. Blachman. *ACM Communications*, v. 4, June 1961, p. 256-265.

* Some General Results on the **Statistical Response** of **Non-Linear Control Systems** by the Theory of Sampling Distribution – A new variable as a standard random process is introduced here from theoretical view point of **sampling distribution.** Various statistical considerations are carried out on the introduced variable, and statistical parameters are determined by the probability distribution of the response. – Yoshikazu Sawaragi, Yoshifumi Sunahara, and Takashi Soeda. *Kyoto University, Engineering Research Institute, Technical Reports*, no. 80, Mar. 1961, 13 pp.

* The Discrepancy From the **Normal Distribution** of the Probability of the Response of Non-Linear **Control Systems** Subjected to a Gaussian Random Input – The approach is carried out by introducing the theory of a Markov process and

solving the Fokker-Planck equation. – Yoshikazu Sawaragi, Yoshifumi Sunahara, and Takashi Soeda. *Kyoto University, Engineering Research Institute, Technical Reports*, no. 79, Mar. 1961, 18 pp.

RF Spectra and Interfering **Carrier Distortion** in FM Trunk Radio Systems With Low Modulation Ratios – This paper provides formulas for evaluating RF spectral shape and interfering carrier distortion in connection with **FM trunk radio systems** having low modulation ratios. Numerical results are given for 1800-speech-channel systems. The curves showing interfering carrier distortion are of particular interest in connection with systems using RF multiplex (i.e., systems consisting of a number of carriers each modulated with a signal built up from a large number of speech channels). Preferred carrier spacings, originally determined for 600-channel systems, have been recommended by the CCIR 9th Plenary Assembly, 1959, for use with up to 1800 channel systems. It appears from the analysis that with these larger numbers of channels, a considerable amount of attenuation by filtering or by isolators will be required to give adequate protection against intermodulation distortion. – R. G. Medhurst. *IRE Transactions on Communications Systems*, v. CS-9, no. 2, June 1961, p. 107-115.

A **Probability Distribution Analyser** Utilizing **Electrostatic Storage** – An instrument is described which, by electronic techniques, provides the one-dimensional probability distribution of any electrical variable. – I. K. Harvey. *Electronic Engineering*, v. 33, July 1961, p. 432-436.

* I-II. A **Digital Approach** to **Power-System Engineering.** III. Digital Computer Program. IV. The Node Transformation and N Graph – Myril B. Reed, et al. *Power Apparatus and Systems*, 1961, no. 54, June, p. 198-226.

Digital Instruments for Accurate **Strip-Process Measurement** – The measuring precision required by modern strip-process industries can best be obtained and maintained **with digital instruments.** These instruments eliminate the drift problems and parameter changes inherent in analog devices. – S. Salowe and W. C. Carter. *Westinghouse Engineer*, v. 21, no. 4, July 1961, p. 117-122.

ELECTRICAL ENGINEERING

Bringing in **Electrical Propulsion** – By clearly defining objectives and accelerating efforts in this field, we can avoid the embarrassment of an "electric gap" in coming space exploration. – Richard J. Hayes. *Astronautics*, v. 6, July 1961, p. 26 + 6 pages.

The **Doppler Shift** for Accelerating Transmitters, Reflectors, and Receivers – Several experiments utilizing two-way doppler measurements of signals reflected from the surface of **Venus** are currently under way. Since neither the Earth nor Venus is an inertial frame of reference, the usual formulas for the doppler shift do not apply. In this report, the equations for the calculation of the shift are developed when the transmitter, reflector, and receiver are accelerating. The results are easily generalized to the case where the transmitter and receiver are not coincident on the accelerating body. – H. Lass and C. B. Solloway. *California Institute of Technology, Jet Propulsion Laboratory, Technical Report No. 32-95*, May 1, 1961, 12 pp. (TL501 C12.4t Contin.)

* The Influence of **Electron Speed Straggling** on the Radiation of **Electron Clots** Moving Uniformly Through a Waveguide – Considers the radiation in a rectangular **waveguide** in a reciprocally perpendicular orientation of the electron beam and the waveguide and in a cylindrical waveguide during the motion of the electron beam along the axis of the waveguide. Gives the numerical evaluation of the influence of the scattering of the speeds on the power of radiation for the radiations of a transient. (*In Russian.*) Vliianie razbrosa skoresteĭ elektronov na izluchenie ravnomerno dvizhushchikhsia elektronnykh sgustkov v volnovodnykh sistemakh. – L. G. Lomize and O. M. Kurbanov. *Zhurnal Tekhnicheskoĭ Fiziki*, v. 31, no. 6, June 1961, p. 657-664.

Aspects of **Electrical Breakdown** of Liquid **Insulating Material.** II – This investigation is continued by considerations on the adsorption of soaps and resins to the impurities which float in the insulating liquid. It was shown that soaps may stabilize the suspension, and resins may do likewise, but if applied both in a certain proportion immediate flocculation and lowering of the breakdown-strength may follow. The action of colloid chemical stabilizers or inhibitors originating from research on dyes has been tentatively explained. – J. A. Kok and C. E. G. M. M. van Vroonhoven. *Applied Scientific Research, Sec. B, Electrophysics, Acoustics, Optics, Mathematical Methods,* v. 9, no. 2, 1961, p. 125-132.

Electroluminescence at *p-n* Junctions in **Gallium Phosphide** – Both diffused and alloyed junctions were prepared from single crystals of GaP cut from ingots grown near the melting point, as well as from crystals grown at lower temperatures. The diodes were characterized by their current-voltage relationship and their capacity at reverse bias. Anomalies in both the forward and the reverse currents, an excess capacity, and a hysteresis effect are attributed to the presence of deep centers in the depletion layer, particularly in the alloyed structures. A nearly compensated layer was found at the junction of the diffused diodes. The spectra, bias dependences, decay times, and efficiencies of the electroluminescence emitted at these junctions at both forward and reverse bias were studied and correlated with the diode models. – M. Gershenzon and R. M. Mikulyak. *Journal of Applied Physics,* v. 32, July 1961, p. 1338-1348.

Revolutionary Era for **Power Transformers** – Among the future possibilities is a transformer with no **copper losses.** – M. E. Fagan. *Westinghouse Engineer,* v. 21, no. 4, July 1961, p. 103-105.

Small Signal Impedance of a **Solid Core Inductance** – The design of a highly stabilized control system for a large electromagnet requires the knowledge of its small signal impedance as a function of frequency. The impedance of such an electromagnet was calculated, taking into account the effects of eddy currents but ignoring nonlinearities in the magnetizing curve of the iron. It has been possible to use typical values for the relative incremental permeability and conductivity of iron to obtain a rather good estimate of its impedance over four decades above the lowest frequency for which reactive components of the impedance are significant. – F. Kollar and R. D. Russell. *British Journal of Applied Physics,* v. 12, June 1961, p. 307-310.

New **Quenching Circuit** of High Quenching Power and High Sensitivity – A circuit is described which produces rectangular quenching pulses of an amplitude up to 2000 *v*, variable from zero to the maximum value. The change in voltage across the counter is independent of the counting rate. An amplifier of high gain can be used so that the sensitivity is 0.3 mv. Self-oscillation, due to the voltage rise at the end of the quenching period, cannot appear. – B. Kalab. *Journal of Scientific Instruments,* v. 38, June 1961, p. 253-257.

Development of Sydney, Nova Scotia-St. John's Newfoundland Canadian National Telegraphs **Microwave Systems** – C. J. Bridgland, A. Piechota, and B. P. MacKenzie. *IRE Transactions on Communications Systems,* v. CS-9, no. 2, June 1961, p. 165-175. (TK1 In6.6cs Vis.)

The Theory of **Negative-Feedback** Voltage Amplifiers – A slight modification is made to the standard method of analysis of negative-feedback **voltage amplifiers.** – C. H. Vincent. *Electronic Engineering,* v. 33, July 1961, p. 442-444.

Silicon Four Layer Devices as High Power **Pulse Generators** – Several circuits are presented showing that pnpn devices in the two- or three-terminal configuration may be used as pulse generators delivering accurately rectangular power pulses for a variety of purposes including transmitters in the 20kW peak input power region. – R. P. F. Lauder. *Electronic Engineering,* v. 33, July 1961, p. 426-431.

° Experience Gained With **Aluminum-Sheathed Power Cables** – The uses, installation, properties, and corrosion protection is discussed. – Friedrich Otten and Lothar Heinhold. *Siemens Review,* v. 28, no. 6, June 1961, p. 192-196.

° Estimation of the Effect of **Meteorological Conditions** on the Electric Strength of the External Insulation – Analysis of the previously published data concerning **electrical insulation.** (*In Russian.*) Ob otsenke vliianiia meteorologicheskikh uslovii na elektricheskuiu prochnost vneshnei izoliatsii. – N. N. Beliakov and V. S. Rashkes. *Elektrichestvo,* 1961, no. 6, June, p. 20-26.

° Utilization of the **Critical Self-Excitation** of a Generator in Closed **Generator-Motor Systems** – It was shown that the utilization of the critical self-excitation of a generator permits lowering the generator power not only when a slowed down course of transients is required, but also when their boosting is necessary. The critical self-excitation of a generator contributes to the improvement of the dynamic properties of the generator-motor system. (*In Russian.*) Ispol'zovanie kriticheskogo samovozbuzhdeniia generatora v zamknutykh sistemakh generator-dvigatel. – V. I. Kliuchev. *Elektrichestvo,* 1961, no. 6, June, p. 26-32.

° Phase-Sensitive **Wave Analysis.** Using **Analogue-Computer** Techniques – A method of phase analysis is described in which the input waveform is applied to one input of a multiplier. The other input takes in turn reference sine and cosine waves generated locally at the harmonic frequencies. To maintain phase-coherence, operation is interrupted in alternate fundamental periods, allowing initial conditions to be reset in the reference wave generator. Results are given for an experimental circuit with a wattmeter performing the function of multiplication. – O. J. Haga and D. Midgley. *Electronic Technology,* v. 38, July 1961, p. 257-261.

° The **Third Harmonics** in Currents and Voltages When Magnetising a **Transformer** – Eric H. Nilsson. *ASEA Research,* no. 4, 1960, p. 83-96.

An Experimental Investigation of the **Electrical and Thermal Conductivity** of Iron and Some Dilute **Iron Alloys** at Temperatures Above 100°K – N. G. Bäcklund. *Physics and Chemistry of Solids,* v. 20, nos. 1-2, June 1961, p. 1-16.

ELECTROCHEMISTRY

° A Study of the Kinetics of **Electrode Processes** With the Help of Electrolysis in Constant Flow. V. Bimolecular Irreversible **Chemical Reoxidation** of the Product of Depolarization – Theoretical relationships were based on the reduction of the oxalate complex of tetravalent Ti, and on the reduction of the triethanolamine complex of trivalent Fe in the presence of a low hydroxylamine excess. The oxidation of hexacyanocomplex of Cr(II) by hydroxylamine in a cyanide medium was studied also. (*In German.*) Studium der Kinetik von Elektrodenvorgängen mit Hilfe der Elektrolyse bei konstantem Strom. V. Bimolekulare irreversible chemische Rückoxydation des Depolarisationsproduktes. – O Fischer, O. Dračka, and E. Fischerová. *Collection of Czechoslovak Chemical Communications,* v. 26, no. 6, June 1961, p. 1505-1520.

° Studies on the **Electrochemical Properties** of Copolymers of **Maleic Acid.** I. Potentiometric Titration at Low Ionic Strength. II. Potentiometric Titration at High Ionic Strength. III. On the Difference of Titration Behaviors Due to Comonomer Species. IV. Comparison of Chelate Formation Constant – From the viewpoint of the neighbor interaction. In the present paper, the potentiometric titrations of two copolymers, **maleic acid-vinyl acetate** and **maleic acid-styrene** copolymers, were studied at low ionic strength, with somewhat different experimental methods from Garrett and Ferry. The empirical equations to estimate the average dissociation constants were presented in comparison with that of the monomeric dibasic acids. The average dissociation constants in various polymer concentrations were obtained and the polydibasic properties were discussed. The sharp difference of titration behaviors between maleic acid-vinyl acetate copolymer and maleic acid-styrene copolymer was briefly considered according to the Kirkwood model for organic ions. The apparent chelate formation constants of alkaline earth metal ions, Ba and Ca, with maleic acid-vinyl acetate and maleic acid-styrene copolymers were evaluated according to Morawetz's method and the comparison between two copolymers was done. – Kazuo Monobe. *Review of Physical Chemistry of Japan,* v. 30, no. 2, 1960, p. 138-168.

° Properties and Evaluation of **Electrolytically Prepared** Types of **MnO_2** – Studies the composition, structure (by X-rays and differential thermal analysis) and size of the specific surface

of manganese(IV) oxide prepared by electrolysis of acid solutions of manganese(II)-sulfate of graphite anodes and platinum anodes at 25, 50 and 80 C. The properties were compared with the depolarizing capacity. The size of the specific surface can serve as a measure of the depolarizing capacity only in the case of oxides of the same structure. (*In German.*) Eigenschaften und Wertung von elektrolytisch hergestellten Arten MnO_2. – V. Srb. *Collection of Czechoslovak Chemical Communications*, v. 26, no. 5, May 1961, p. 1231-1241.

a • New Investigations Concerning the Existence of **Complex Cations** Having a Definite Structure in **Electrolyte Solutions** – Studies the frequencies and factors of depolarization in certain Raman bands observed in solutions of Mg and Al salts in light water and heavy water, which are attributed to complex cations of the $Me(OH_2)_6$ and $Me(OD_2)_6$ form. With the aid of certain hypotheses it is possible to calculate the proper frequencies of these complexes; they are close to the experimental frequencies. (*In French.*) Nouvelles recherches sur l'existence de cations complexes de structure définie dans les solutions d'électrolytes. – Antonio da Silveira, Manuel A. Marques, and Noemio M. Marques. *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 252, no. 25, June 19, 1961, p. 3983-3985.

b • The **Electroreduction** of Uranium (VI) Compounds in Carbonate Solutions – The reduction of the uranyl carbonate ion to uranium oxide in aqueous solutions of Na_2CO_3 and $NaHCO_3$ at a lead electrode has been investigated. The reduction rate increases with increasing temperature and pH, and decreases with increasing concentration of carbonate ions in the solution. It was found that the reduction of the $UO_2(CO_3)_2(H_2O)_2^{2-}$ ion at the mercury dropping electrode in carbonate solutions insignificantly depends on the concentration of carbonate ions and on pH of the solution. The mechanism of the **uranyl carbonate** ion reduction at the Pb-electrode has been proposed. (*In Polish.*) Elektroredukcja zwiazków uranu sześciowartościowego w roztworach weglanowych. – Mieczysław Perec. *Nukleonika*, v. 6, no. 5, 1961, p. 357-369.

c • Electrochemical Properties of **Lead Oxides** – Studies the oxide **reducing system** Pb(II)/Pb(IV), and the applications of some intensity-potential curves to the possibility of anticipating electrochemical reactions. The reaction of oxidation of methionine by lead dioxide was taken as an example. Intensity-potential curves for the oxidation of water in the entire pH domain and with different electrodes (Pt, PbO_2, Tl_2O_3) were plotted. (*In French.*) Propriétés électrochimiques des oxydes de plomb. – Magdeleine Machtinger-Convers. *Annales de Chimie*, v. 6, Mar.-Apr. 1961, p. 395-448.

d • Cathodic Yield and Polarization of Cyanide Baths in **Cadmium Plating** – The **electrolyte composition** for which the depositions obtained possess certain special physical properties can be determined. Cathodic yield curves were plotted on the basis of Cd concentration, total cyanide-metal ration, concentration of soda, carbonate, sodium sulfate and iron, and temperature. The effects of the cathodic yield on the cathodic and anodic polarization processes were studied. (*In French.*) Rendement cathodique et polarisation des bains cyanurés de cadmiage. – L. Adès. *Corrosion et Anticorrosion*, v. 9, no. 6, June 1961, p. 185-194.

e • Elimination of Zinc From Commercial **Nickel Sulfate** Solutions When Using Radioactive Zinc[65] – After a survey of the methods known the author examines the electrolytic **elimination of Zn** before the precipitation of the bulk of the Ni contents, determines the optimum working conditions for electrolytic elimination by the tracer method and tries to explain the mechanism of extraction. (*In German.*) Zinkentfernung aus technischen Nickelsulfatlösungen unter Verwendung radioaktiven ^{65}Zinks. – Alfred Lange. *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 14, June 1961, p. 283-292.

f • Progress in **Electroplating** in the U.S.A. – Improvement in the protective effects of decorative coatings for external parts is the most important development in electroplating in the U.S. during recent years. Increase of the Ni protective layer thickness from 20 μm to 30 μm were obtained for external parts of automobiles. The greatest progress consists in the use of duplex-Ni layers instead of polished sheet Ni, and in the increase of the Cr layer thickness up to 0.75 μm. Thus the

Cr layers are three times as thick as those deposited in 1958. These thicker Cr coatings can be free from cracks and microfissures. The durability of the electroplated part is tripled. The new Ni and Cr plating methods have been used for only five and three years respectively; nevertheless about 75% of the electroplating plants treating external parts for automobiles work more or less on the basis of the new processes. (*In German.*) Fortschritte der Galvantotechnik in den USA. – W. H. Safranek and Ch. L. Faust. *Metall*, v. 15, June 1961, p. 539-542.

g • Multicolored Effects on **Anodized Aluminum** – Several techniques are presented for **color treating** anodized Al. – A. Jogarao, B. A. Shenoi, and K. S. Indira. *Metal Finishing*, v. 59, July 1961, p. 42-45.

h • Sealing of **Anodic Coating of Aluminum** – A discussion of several methods for **sealing** the anodic coatings of Al. – B. A. Shenoi, K. Vijayalakshmi, and K. S. Indira. *Electroplating*, v. 3, no. 1, Jan.-Mar. 1961, p. 7-13.

i • The Temperature Coefficients of **Electrode Potentials.** II. The Second Isothermal **Temperature Coefficient** – Values of the second coefficient are tabulated for 58 standard electrodes, together with the first coefficients. Application of the data to fuel cells, and to emf-temperature relationships, is discussed. – G. R. Salvi and A. J. deBethune. *Electrochemical Society, Journal*, v. 108, July 1961, p. 672-676.

j • Intermediate Temperature **Fuel Cells** – Gas fuel cells are described which utilize **aqueous electrolytes** and operate at atmospheric pressure at over 100 C. – G. V. Elmore and H. A. Tanner. *Electrochemical Society, Journal*, v. 108, July 1961, p. 669-671.

k • The **Discharge Mechanism** of Certain **Oxide Electrodes** – The discharge of PbO_2, TiO_2, and Tl_2O_3 electrodes were studied and are compared with similar discharges of the MnO_2 electrode. – Harry B. Mark, Jr. and W. C. Vosburgh. *Electrochemical Society, Journal*, v. 108, July 1961, p. 615-621.

• Anodic Polarization Curves in Molten **Carbonate Electrolysis** – Some **anodic polarization** curves for Pt, Au, and Ag, for molten carbonate electrolysis in the range 500-900 C and 10^{-6}-10^{-3} amp cm^{-2} are reported. – George J. Janz and Fumihiko Saegusa. *Electrochemical Society, Journal*, v. 108, July 1961, p. 663-669.

• The Kinetics of the **Iodine Redox Process** at Platinum Electrodes – Three paths for the iodine redox process **at platinum electrodes** are discussed with reference to stationary current/potential curves obtained for the cathodic reduction of the tri-iodide ion in potassium iodide solutions. – J. D. Newson and A. C. Riddiford. *Electrochemical Society, Journal*, v. 108, July 1961, p. 699-706.

• Limiting Currents for the **Reduction** of the **Tri-Iodide Ion** at a Rotating Platinum Disk Cathode – J. D. Newson and A. C. Riddiford. *Electrochemical Society, Journal*, v. 108, July 1961, p. 695-698.

• Development of a 10,000-Ampere Cell for **Electrorefining Titanium** – The Federal Bureau of Mines developed a 10,000-ampere cell to determine the economic feasibility of producing high-purity electrolytic Ti from mill scrap or offgrade sponge. Operating variables were investigated, material-handling procedures were established, and the cost of electrorefining Ti was determined. – F. P. Haver and D. H. Baker, Jr. *U. S. Bureau of Mines Report of Investigations* 5805, 1961, 42 pp. (TN21 Un3r Room 290)

• Direct **Chromium Plating** on Zinc Pressure Die Casting. A Comprehensive Investigation of Four Fundamental Electrolytes – For a usual chromic acid bath the cathode current density-potential curves consist of four stages in succession. The first, with comparatively the oldest potential, consists in the reduction of Cr(VI) to Cr(III). The second stage presents the structure of a chromium oxide film. The film does not allow penetration of chromate ions, but permits of the discharge of H ions which form a base for the third stage. The violent H development and the separation of the metallic Cr occur in the fourth stage. (*In German.*) Die Direktverchromung auf Zinkdruckguss. Eine vergleichende Untersuchung an vier Grundelektrolyten. – A. M. Shams. *Metalloberfläche*, v. 15, June 1961, p. 168-173.

• **Kinetics** of the Anodic Electrolytical Oxidation of **Tungsten** – Kinetics of the **anodic oxidation** of hugh purity tungsten (99.989% W) in the recrystallized and cold worked states in 30% sulfuric acid have been studied by the charge curve and polarization curve methods. Under the experimental conditions (anodic current density up to 50 ma/cm², temperatures 10-40 C) it has been found that cold working considerably increases the rate of the oxidation process. Kinetic equations have been derived, correlating the constant rate of change of potential and unitary rate of formation of tungsten oxides with the anodic current density. A relation has also been found between the unitary rate of formation and anodic current values and the effective field of formation. From the data the values of the parameters have been obtained, permitting calculation of the activation energy barrier of the oxidation reaction for the recrystallized and cold worked tungsten. (*In Russian.*) Kinetika elektroliticheskogo anodnogo okisleniia vol'frama. – V. A. Lavrenko. *Zhurnal Prikladnoĭ Khimii*, v. 35, no. 5, May 1961, p. 1095-1102.

Electrolytic Polishing of Refractory Metals – A versatile solution, composed of small amounts of sulfuric and hydrofluoric acids in methanol, which can be used to electropolish four **refractory metals--Mo, W, Ta, Cb.** Grinding and polishing procedures are also described. – F. R. Cortes. *Metal Progress*, v. 80, no. 2, Aug. 1961, p. 97-100.

ELECTRONICS

Analytical Prediction of **Electromagnetic Environments** – This paper discusses three efforts made by the government to predict the status of future environments. In all cases, the basic technique of **analytical prediction** calls for the solution of mathematical models by digital computer. Results from these analyses are useful to the designer of future systems as well as to the operators who must use them. The responsibility of keeping the signal congestion within bounds rests with the designer and user alike. – W. H. Tetley, *IRE Transactions on Communications Systems*, v. CS-9, no. 2, June 1961, p. 175-185.

Secondary Surveillance Radar. I – In this article the principles and fundamental characteristics of **secondary radar** are discussed and some of the system design problems are set forth. – D. H. R. Archer. *Electronic Engineering*, v. 33, July 1961, p. 414-420.

An Experimental Study of **Bistatic Scattering** From Some Small, Absorber-Coated, Metal Shapes – Experimental data are presented on the bistatic scattering cross sections of some small metal bodies, **uncoated and coated** with a resonant, lossy layer. All of the **targets**--spheres, cylinders, and cones--are of a size to be in the resonant region at wavelengths of approximately 3 cm. All of the bodies indicate a similar trend--the coated bodies are effectively camouflaged in the back hemisphere, but not in the forward hemisphere. In the forward direction, the scattering cross sections of the coated bodies are at least as large as, or larger than, those of the uncoated bodies. The bistatic angles beyond which this enhancement is effective become smaller as the electrical size of the body decreases, i.e., as frequency decreases. – R. J. Garbacz and D. L. Moffatt. *IRE Proceedings*, v. 49, July 1961, p. 1184-1192.

Modifying an F-M Transmitter for Compatible **Stereo Multiplex** – To transmit compatible stereo with the system recently adopted by the FCC, the f-m transmitter must be modified. Here is how one typical f-m station is doing it. – *Electronics*, v. 34, no. 28, July 14, 1961, p. 60-62.

Digital Computer Simulation for Prediction and Analysis of Electromagnetic Interference – A **digital computer simulation** program is described for use by **communications systems** and equipment designers who must consider **electromagnetic interference.** – D. R. J. White, and W. G. James. *IRE Transactions on Communications Systems*, v. CS-9, no. 2, June 1961, p. 148-159.

Studies of **Electron Tube Materials** and **Thermionic Emission Processes** – Studies of **ultrapure nickel** based cathodes and emission microscopy are reported. – *U. S. Air Force, Cambridge Research Laboratories, AFCRL*-313, Apr. 5, 1961, 38 pp. + 2 plates. (TK7800 Un3.12af Contin.)

The Case for **Waveguide Communications** – The promise of **long-distance communications** by Earth satellites has pushed into the background the development of techniques for carrying enormous amounts of information in a small tube. Nevertheless, the expected demands for communications channels within Britain can only be met with such a system. – H. M. Barlow. *New Scientist*, v. 10, June 29, 1961, p. 778-780.

• Electromagnetic Wave Propagation Over **Gyrotropic Medium** – Considers a plane separation boundary between a vacuum and a uniform absorbing anisotropic medium; the **electromagnetic wave propagation** over this medium in the vacuum is studied. (*In Russian.*) Rasprostranenie elektromagnitnykh valn nad girotropnoi sredoi. – M. D. Khaskind. *Radiotekhnika i Electronika*, v. 6, no. 6, June 1961, p. 886-894.

• Comparison Between **Mode Theory** and **Ray Theory** of **VLF Propagation** – Shows that field strengths are derivable from the same expression of the original vector potential, and the result of one theory is the analytic continuation of the other one in another range of convergence. – H. Volland. *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation*, v. 65D, no. 4, July-Aug. 1961, p. 357-361.

• A Solution to the Boundary Value Problem of **Radiowave Propagation** About the Earth With Allowance for the Main Geophysical Factors – The problem deals with a particular case of solution for 3 spherical layers: zero layer--the earth, 1st layer--ideal atmosphere, and the 2nd layer--ionosphere, considered as an electron-ionic plasma located in the vertical magnetic field of the earth, characterized by an electronic concentration and by a frequency of collision of electrons with other particles. (*In Russian.*) Reshenie kraevoi zadachi rasprostraneniia radiovaln vokrug zemli s uchetom geofizicheskikh faktorov. – P. E. Krasnushkin. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 5, 1961, p. 1055-1058.

• Conversion of a **Photoelectron Multiplier** Current Pulse Into a Voltage Pulse Using an **Emitter Repeater** – Considers the peculiarities of a photoelectron multiplier **current pulse conversion** into a voltage pulse by means of the cascade of an emitter repeater. The nonlinearity of the conversion was determined and the unstability factor was evaluated. (*In Russian.*) O preobrazovanii impul'sa toka fotoelektronnogo umnozhitelia v impul's napriazheniia emitternym povtoritelem. – L. S. Gorn and B. I. Khozanov. *Radiotekhnika i Elektronika*, v. 6, no. 6, June 1961, p. 1010-1014.

• Geometrical Parameters of Ion Focused **Electron Beams** – The problem of **ion focusing** of uniform cylindrical, ribbon, and cylindrical hollow electron flows is considered, using a simplified method. (*In Russian.*) Geometricheskie parametry elektronnykh puchkov pri ionnoi fokusirovke. – L. E. Bakhrakh and Iu. D. Zharkov. *Radiotekhnika i Elektronika*, v. 6, no. 6, June 1961, p. 976-981.

• **Decouplings** of Two Closely Spaced **Mirror Antennas** – On the basis of the geometric diffraction theory different types of couplings between the large size mirror antennas are analyzed. (*In Russian.*) Razviazki mezhdy blizko raspolozhennymi zerkal'nymi antennami. – B. E. Kinber. *Radiotekhnika i Elektronika*, v. 6, no. 6, June 1961, p. 907-916.

Pulse-Sampling Voltmeter and Its Application to **Transistor Testing** – Designed for measuring low-frequency transistor current gain under large signal conditions. The equipment presents an input resistance of at least 200 kΩ on all ranges and measures voltages from 100 mv to 75 v with an accuracy to 1%; the upper limit could be extended. – L. J. Herbst and J. R. W. Smith. *Journal of Scientific Instruments*, v. 38, June 1961, p. 242-245.

Positive and Negative **Feedback** Multiply Amplifier **Input Impedance** – Results in a stable amplifier with an input conductance adjustable to zero. This input characteristic may be achieved with almost any output load. – R. L. Willett. *Electronics*, v. 34, no. 27, July 7, 1961, p. 52-53.

• Direct Microwaves-to-Electricity Power Seen Near – Solid-state **diodes** and inverse **magnetrons** are being developed for direct **conversion** of **microwave power.** – Manfred Meisels. *Electronic Design*, v. 9, no. 14, July 5, 1961, p. 131-135.

Microelectronic Systems Enigneering – Several general requirements for microelectronic systems are grouped under three main headings: **power dissipation, topology,** and **reliability.** – J. D. Meindl and H. Jacobs. *Electrical Engineering,* v. 80, July 1961, p. 484-486.

Prediction of **Coverage** for Trans-Horizon HF Radar Systems – Coverage patterns for **transhorizon radar systems** can be predicted both analytically and empirically. Empirical methods are preferred because of their rapid application and lack of need for elaborate computing facilities. In addition, the coverage techniques introduced may be used eventually to determine the slant range, absorption, and effective noise temperature of transhorizon radar systems. Some of the fundamental considerations which influence the prediction of coverage, such as geographical location, and the diurnal, seasonal, and anomalous behavior of the ionosphere, are discussed qualitatively. In spite of these factors, however, it is shown how HF radar systems overcome the line-of-sight limitations imposed upon conventional microwave radar systems and theoretically permit up to four or five times the range for a single hop. – G. F. Ross and L. Schwartzman. *IRE Transactions on Military Electronics,* v. MIL-5, no. 2, Apr. 1961, p. 164-172. (TKI In 6.6mi Contin.)

Our new format should help you scan the page quickly. Boldface clue words identify subject matter. Titles appear unchanged at the beginning of each abstract.

Propagation in Periodic Electron Beams – A small-signal analysis of smooth electron beams with periodic variations in their dc parameters reveals the existence of infinite sets of space harmonics of the fast and slow space-charge waves. For a finite beam coupling between the space-charge waves and field waves exists at an infinite number of frequencies. The periodicity of a beam has a very small effect on the space-charge wave propagation constants. Velocity-jump, rippled-stream, and rippled-wall amplification are shown to result from coupling between fast and slow space-charge waves of adjacent harmonics. – W. M. Mueller. *Journal of Applied Physics,* v. 32, July 1961, p. 1349-1360.

Experimental Physchology . . . a New Variable in Design – The human sensor–the **eye;** the human imaging tube--perception capability; human **information processing;** humans as **systems components.** – A. Kahn. *Westinghouse Engineer,* v. 21, no. 4, July 1961, p. 112-116.

The Electron Beam Parametric Amplifier as a Radar System Component – Practical experience is now available with the **Electron Beam Parametric Amplifier** (EBPA) used as a low-noise preamplifier in **radar systems.** Principles of operation of the EBPA are briefly recapitulated. Among its desirable characteristics are unilateral behavior, high stable gain and a double-channel noise figure (NF) of 1 db or less; its bandwidth, input and output impedance remain constant as gain is adjusted. An *L*-band amplifier is described in detail. A discussion of various ways of handling the idler channel follows. The technique of in-pass-band pumping achieves an effective NF of 2.5 db or better in radars with conventional detection. Complications arise with Moving Target Indicator (MTI) systems; remedies are described. The paper reports on field tests in which these techniques were used, including a few flight tests. The results show substantial improvements in sensitivity and range. They also spotlight the ability of the EBPA to tolerate high overload and to act somewhat like a TR switch. – R. Adler and W. S. Van Slyck. *IRE Transactions on Military Electronics,* v. MIL-5, no. 2, Apr. 1961, p. 66-71. (TKI In6.6mi Contin.)

* The Propagation of **Electromagnetic Waves** Through Cross-Shaped **Waveguides** With a Transversal Magnetized **Ferrite Plate** – A transcendent equation concerning the constant of **propagation** in this type of waveguides was obtained and the phase shifts and losses were examined. The cross-shaped waveguides containing a magnetized ferrite plate shift the phase of the wave more than the rectangular waveguides of juxtaposed dimensions. (*In Russian.*) Rasprostranenie elektromagnitnykh voln v volnovodakh krestoobraznogo secheniia, soderzhashchikh

poperechno namagnichennuiu ferritovuiu plastimu. – N. M. Kovshun and A. I. Tereshchenko. *Zhurnal Tekhnicheskoĭ Fiziki,* v. 31, no. 6, June 1961, p. 704-711.

Automatic Frequency Control of **Magnetrons** – A practical **AFC** system for both *X*-band and *Ku*-band magnetism **radar transmitters** has been developed. This system meets the needs of three radar systems currently in production. **Frequency stabilization** is accomplished by electronically controlling the magnetron load impedance. Therefore, the magnetron "pulling figure" is put to use. The closed loop AFC system maintains frequency stability to better than ±2 Mc at *Ku*-band and ±1.5 Mc at *X*-band frequencies over wide environmental conditions. The system dynamically compensates for deviations in frequency due to temperature, vibration, shock, changes in duty cycle, drift with life, and poor voltage regulation. The response time of the AFC system is such that, starting at the limits of the capture range, "on frequency" response is obtained within the first five pulses of the magnetron. One of the radar systems requires a considerable delay between groups of pulses. For this radar, the AFC system provides a memory to hold the conditions for "on frequency" response during the delay periods. – Austin R. Sisson, *IRE Transactions on Military Electronics,* v. MIL-5, no. 2, Apr. 1961, p. 45-50. (TKI In6.6mi Contin.)

Zener Diode Creates Logarithmic **Pulse Amplifier** – Circuit is all solid state and is largely unaffected by minor temperature changes. – David Ophir and Uzia Galil. *Electronics,* v. 34, no. 28, July 14, 1961, p. 68 + 1 page.

ENGINEERING ECONOMICS

Mining In The Arctic . . . The Future Prospect Brightens – Examines two million square miles of the northern hemisphere, which the geographer defines as the terrestrial Arctic, a land region in which the mean temperature of the warmest month is below 50 F--in effect, the area lying north of the tree line. – Paul E. Queneau. *Mining Engineering,* v. 13, July 1961, p. 694-699.

* **Employment Problems** in a Changing Economy – Deals with five major problems: The change in the age structure of the working-age population; the rise in the level of chronic unemployment; the imminence of a sharp rise in the size of the labor force; significant changes in the occupational and industrial character of employment opportunities; and the ways in which man power is being wasted. – Sanford Cohen. *Business Horizons,* v. 4, no. 2, Summer 1961, p. 71-76.

* Need We Fear **Japanese Competition?** – Competition from Japan, more than that from any other country, has been widely recognized as a threat to U.S. industry. However, it is to the advantage of the U.S. for Japan to be strong economically. Japan is an important customer for U.S. products now, and as her economy grows, Japan is likely to become an even better customer. The continued economic strength of Japan is also very important from the standpoint of American foreign policy. – Stewart H. Rewoldt. *Business Horizons,* v. 4, no. 2, Summer 1961, p. 27-34.

Where the **Russian Gas Industry** Is Headed – A first-hand report on U.S. delegation's USSR trip. – William R. Connole. *Oil and Gas Journal,* v. 59, no. 32, Aug. 7, 1961. p. 80-83.

Oil, Gas Will Still Dominate **1980's Energy Market** – The nation's energy needs will continue their spectacular growth over the next 20 years. Petroleum and gas still will dominate the supply picture in spite of big gains expected for electricity. – *Oil and Gas Journal,* v. 59, no. 29, July 17, 1961, p. 46-47.

What You Should Know About **Belgium** . . . Market, Rival, Investment Base – This report is based on "Rundt's Market Report No. 312", May 23, 1961, issued by S. J. Rundt & Associates, New York consultants on international business. – *Steel,* v. 149, July 10, 1961, p. 47-50.

* Economic Life of **Construction Equipment** – The mobile equipment used in highway and other heavy construction work usually has a shorter life and higher repair costs than stationary

factory machinery of similar value. This article gives methods for figuring repair and **depreciation** costs. – Herbert L. Nichols, Jr. *Cost Engineering*, v. 6, no. 3, July 1961, p. 4-9.

• Public Control of Industry Affairs: The Road Ahead – Washington is optimistic about "tripartite" **labor-management-government committees.** Their existence, key men say privately, means industry is marturing, realizing third-party participation in its affairs is inevitable. Most plant men still reject third-party intrusion into their affairs. – Lawrence F. Mihlon. *Factory*, v. 119, July 1961, p. 61-63.

• New Forms of **Manufacturing Competition** – Even though the spread between direct costs and sales price is becoming greater, this spread does not mean higher prices. In fact, management must obtain the increasing sales volume necessary to carry the company's overhead expenses through lower unit costs and better products. – John Parkany. *Business Horizons*, v. 4, no. 2, Summer 1961, p. 85-92.

• Preliminary **Cost Estimating** for Processing Equipment Installations – Presents cost data on installation of **chemical process equipment** obtained from major expansions in chemical plant production facilities. – William O. Dietsche. *Cost Engineering*, v. 6, no. 3, July 1961, p. 10-15.

• **Laboratory Location** – When selecting the location of a new research laboratory, corporation **management** must consider many factors. Most important is the relation of the site to personnel needs. – George Philips. *Frontier*, v. 23, no. 1, Summer 1961, p. 14-17.

How to Estimate **Plant General Costs** – The plant general expenses of operating a **petro-chemical plant** are the overhead costs. Thus costs incurred in purchasing, accounting, engineering, and traffic activities are typical plant general expenses. – Oliver Axtell and R. M. Pritchett. *Petroleum Refiner*, v. 40, July 1961, p. 123-124.

The **U.S. Industrial Outlook** for 1961; 91 Selected Industries – Gives résumés and forecasts of production in the more important industries. – 262 pp. 1961. U. S. Government Printing Office, Washington, D. C. (HC106.5 Un3.1u)

How to Improve Productivity; Why Some Attempts Fail – The first step to improve **worker productivity** is to understand why some approaches fail to reach the workers at all. This is the first of a three-part series on worker productivity. It tells why some accepted methods are doomed from the start. – R. N. McMurry. *Iron Age*, v. 188, no. 2, July 13, 1961, p. 67-69.

• The **Unemployment Problem**--What Should Be Done About It? – A searching look at causes and cures. – *Factory*, v. 119, July 1961, p. 85-90.

• Shades of the Alchemists – Modern steelmen, blending science with a knack for sales, have found so many valued **uses for slag,** that it has risen from the dumps to enviable stockpile status. – *Steelways*, v. 17, no. 3, May 1961, p. 8-10.

• Egypt's Need for **Marketing Management** – In the absence of a competitive market to "regulate" the economy, **Egypt** must somehow take steps to incorporate the marketing concept into the thinking of management. Failure to do so will prove increasingly costly and will minimize Egypt's chances of sustaining its economic development program through earning needed foreign exchange by the export of its manufactured goods. – Harper W. Boyd, Jr., Abdel Aziz El Sherbini, and Ahmed Fouad Sherif. *Business Horizons*, v. 4, no. 2, Summer 1961, p. 77-84.

FLUID MECHANICS

• Refraction of Detonation Waves by Incidence on the Boundary Between Two **Gaseous Mixtures** – Discusses one of the processes characteristic for **detonation waves:** the **refraction** during the passage from one explosive mixture to the other. High speed photographs were taken of the process occurring during the approach of the detonation wave to the boundary of the demarcation of the mixture capable of reaction with inert or **explosive mixtures.** (*In Russian.*) Prelomlenie detonatsionnykh voln pri padenii na granitsu razdela dvukh gazovykh smesei. – L. G. Gvozdeva. *Zhurnal Tekhnicheskoĭ Fiziki*, v. 31, no. 6, June 1961, p. 731-739.

a

• The Moment of **Friction** Forces on the Surface of a **Disc** With the Flow of Liquid Through the Axial Gap in Direction From Circumference to the Center – Experimental results are cited on the determination of the resistance moment to the rotary motion of a disk at a turbulent **liquid flow** from circumference to the center. (*In Russian.*) Moment sil treniia na polotne diska pri techenii zhidkosti v aksial'nom zazore ot periferii k tsentru. – V. S. Sedach and A. N. Nespela. *Teploenergetika*, no. 7, July 1961, p. 32-35.

b

• **Three-Dimensional Flows** Inside a **Cylinder** – It is the purpose of this work to derive functions which represent the flow of a perfect fluid inside a cylindrical wall. The velocity perpendicular to this wall must be zero everywhere. Some of the problems discussed will have the axis of the cylinder as an axis of symmetry, but several problems are discussed where the flow is not symmetric about an axis. – Thomas C. Benton. *Quarterly of Applied Mathematics*, v. 19, no. 2, July 1961, p. 81-94.

c

• A Certain Exact Solution to the Equations of One-Dimensional Relativistic **Fluid Dynamics** With a Discontinuity in the Transformation of the Residual Mass of Matter – (*In Russian.*) Ob odnom tochnom reshenii uravnenii odnomernoi reliativistskoi gidrodinamiki so skachkom preobrazovaniia ostatochnoi massy veshchestva. – V. A. Skripkin. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 1, May-June 1961, p. 81-83.

d

• **Discontinuity Surfaces** With Liberation or Absorption of Energy in **Magnetic Hydrodynamics** – Discontinuity surfaces with liberation or absorption of energy are considered in a conducting medium at an arbitrary magnetic field. Assumption is made that the conductivity of the medium is infinite. (*In Russian.*) Poverkhnosti razryva s vydeleniem ili pogloshcheniem energii v. magnitnoi gidrodinamike. – A. A. Barmin. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 1, May-June 1961, p. 77-80.

e

• Formulation of the Theory of **Turbulence** in an Incompressible Fluid – The theory of turbulence in an **incompressible fluid** is formulated using methods similar to those of quantum field theory. A systematic perturbation theory is set up, and the terms in the perturbation series are shown to be in one to one correspondence with certain diagrams analogous to Feynman diagrams. Truncation of the integral equations at the lowest nontrivial order yields Chandrasekhar's equation, and truncation at a higher order yields the equations discussed by Kraichnan. – H. W. Wyld, Jr. *Annals of Physics*, v. 14, July 1961, p. 143-165.

f

Measurement of **Free Surface Motion** by the **Slanted Resistor Technique** – A method is being developed for observing the motion of a free surface immediately following the arrival of a **shock wave.** The method uses the electrical signal produced by the shorting of a resistance wire placed close to the free surface. The experimental configuration is described in detail. – L. M. Barker. *U. S. Atomic Energy Commission, SCDR*-78-61, May 1961, 19 pp. (UF767 Un3.1sd Contin.)

g

FOOD TECHNOLOGY

Radioresistance of Five Strains of **Clostridium botulinum** in Selected Food Products – Spore recovery counts made on five strains of Clostridium botulinum indicated striking differences in **bacterial radioresistance.** Since the character of the food determines in part the dose required for destruction, no single dose would be best for all food products. – E. Wheaton, G. B. Pratt, and J. M. Jackson. *Journal of Food Science*, v. 26, no. 4, July-Aug. 1961, p. 345-350.

h

i

Oxidative Damage to Amino Acids, Peptides and **Proteins** by Radiation – **Radiation effects** occurring in treatment of foods. – K. S. Ambe and A. L. Tappel. *Journal of Food Science*, v. 26, no. 4, July-Aug. 1961, p. 448-451.

j

• New Horizons for Food – A forecast of trends in **food processing.** – Jane C. Ebbs. *American Dietetic Association, Journal*, v. 39, Aug. 1961, p. 101-104.

k

• Nutritional Value of **Dehydrated Foods** – Compares content of various animal and vegetable products before and after dehydration, **irradiation,** and the conventional **thermal process-**

ing. Data have also been presented on the effect of storage on dehydrated meat products, as well as the digestibility of dehydrated foods and certain functional characteristics. In general, the results indicate that, among the methods and products studied, nutrient content is affected least by dehydration. Excellent vitamin stability was noted during storage of dried meats. – Miriam Higgins Thomas and Doris Howes Calloway. *American Dietetic Association, Journal,* v. 39, Aug. 1961, p. 105-116.

An Investigation of Some Volatile Components of **Irradiated Beef** – It has been proved that 3-(methylthio)-propionaldehyde (methional) makes a major contribution to the **unpleasant odor** of irradiated beef. The synthesis of methylthioacetaldehyde, ethylthioacetaldehyde, and 2-(methylthio)-propionaldehyde is reported. – Emily L. Wick, et al. *Journal of Agricultural and Food Chemistry,* v. 9, July-Aug. 1961, p. 289-293.

FUELS AND COMBUSTION

• **Fuel and Energy Requirements** for Some Possible Future **Steelmelting Processes** – Suggests a design for a hot metal process using various proportions of cold scrap with O blowing and fuel firing to give flexibility designed from first principles. Shows a proposed design for a combined arc and fuel melting furnace which uses electric energy for the final high-temperature stage, but fuel firing for preheating the scrap where the first stage of scrap heating acts as a thermal precipitator to remove fume from the gases. – M. W. Thring. *Institute of Fuel, Journal,* v. 34, July 1961, p. 272-274 + 4 plates.

• **Atomization** of Liquid **Fuel** for Combustion. I – Considered as a mass transfer operation. Factors influencing the rate of evaporation of drops and sprays are discussed. – Paul Eisenklam. *Combustion,* v. 33, no. 1, July 1961, p. 22-29.

Developments in the Chemistry of **Boron** Compounds – A critical review of the papers presented to the **symposium** on boron compounds forming part of the anniversary meeting of The Chemical Society held in April in Liverpool. – R. A. Shaw. *Industrial Chemist,* v. 37, July 1961, p. 335-338.

A **New** Type of **Boron Hydride,** $B_{10}H_{16}$ – New compound is prepared by the slow passage of B_5H_9 in an atmosphere of H_2 through an electric glow discharge between Cu electrodes. – Russell Grimes, Frederick E. Wang, Ruth Lewin, and William N. Lipscomb. *National Academy of Sciences, Proceedings,* v. 47, July 1961, p. 996-999.

Methyl-Acetylene as a **Rocket Fuel** – It is concluded that methyl-acetylene has possible uses as a monopropellant fuel for a rocket powerplant, when the products of its initial decomposition in a rocket or gas generator chamber are burned with air in an afterburner system. – F. Fitzgerald. *Fuel,* v. 40, no. 4, July 1961, p. 275-278.

• The Relationship Between the Chemical and Plastic Properties of **Alabama Medium-Volatile Coals** and Their **Carbonization** Behavior – B. R. Kuchta and J. D. Clendenin. *Blast Furnace and Steel Plant,* v. 49, July 1961, p. 648-653.

• Interferometric Measurements of a Flat Laminar Flame – The **interferometric** temperature measurement in flat flames shows itself to be a very simple and exact method for determining **temperature profiles.** The error caused by the deflection of the light beams is of negligible order. (*In German.*) Interferometrische Messungen an einer Ebenen Laminaren Flamme. – F. Schultz-Grunow and G. Wortberg. *International Journal of Heat and Mass Transfer,* v. 2, nos. 1-2, Mar. 1961, p. 56-68 + 2 plates.

Carbonizing Tests With Tuscaloosa Oven: Studies of Pushing Pressures – Study was made to correlate results of previous investigators and to supplement these results to the limited extent, practical by use of an experimental, slot-type oven. To this end, pushing pressures have been determined routinely for **Tuscaloosa oven** tests conducted during the past 10 years, but the accumulated information still remains incomplete. – J. B. Gayle and W. H. Eddy. *U. S. Bureau of Mines Report of Investigations* 5807, 1961, 14 pp. (TN21 Un3r Room 290)

Coal Research Organizations: Their Activities and Publications – List includes government, university, private, and commerical **organizations.** – Mary S. Esfandiary. *U. S. Bureau of Mines Information Circular* 8008, 1961, 64 pp. (TN21 Un3i Room 290)

• Treating No. 2 Fuel Ups Performance, Cuts Costs – Tests show ability of additives to **inhibit** formation of **gum deposits** to extend the life of **diesel fuel** injector cups and plungers, keep power output up, and fuel consumption down. – Jess P. Smither. *Diesel and Gas Engine Progress,* v. 27, July 1961, p. 26-27.

The Use and Interchangeability of **Fuels** in Pennsylvania – An investigation into the current and future uses of fuels. Consideration of **interchanging** fuels for different uses. – W. Gibson Jaworek and John J. Schanz, Jr. *Pennsylvania State University, Mineral Industries Experiment Station, Bulletin No.* 74, 1961, 46 pp. (TN21 P38b Vis.)

• **Coal** Conveying and Conditioning – The **handling** and processing of coal to be used for fuel. – A. S. Drummond. *Power Engineering,* v. 65, July 1961, p. 66-69.

Monomethylenation and Polymethylenation by **Diazomethane** in the Presence of **Boron Compounds** – Alwyn G. Davies, D. C. Hare, O. R. Khan, and J. Sikora. *Chemical Society, Proceedings,* 1961, May, p. 172.

• **Interferometry** as an Aid to Studying Coal Sections – Approach offers, in a simple manner, useful, new information about the banded structure **of coal.** – S. Tolansky. *Laboratory Practice,* v. 10, July 1961, p. 465-468.

• **Thermal Energy** From Indigenous Vegetation. I. Harnessing Solar Energy by **Biosynthesis** – H. A. S. Gothard. *British Power Engineering,* v. 3, no. 2, July 1961, p. 52-57.

• Predicted Burning Times of **Solid Particles** in an Idealized Dust Flame – **Burning times** have been calculated on the separate assumptions of reaction control; by a diffusion film, and by surface chemical reaction. – R. H. Essenhigh. *Institute of Fuel, Journal,* v. 34, June 1961, p. 239-244.

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

• **Solar X-Rays** – The solar eclipse experiment of Oct. 12, 1958, helped to isolate the sources of X-rays on the solar disc and also showed that the residual coronal emission could account for the presence of E-region ionization during totality. An X-ray picture of the sun, made with a pin-hole camera in 1960, showed a close correlation with the Ca K line plage pictures made on the same day. These two experiments revealed that most of the solar X-ray radiation came from active regions rather than from a uniform corona. – R. W. Kreplin. *Annales de Géophysique,* v. 17, no. 2, Apr.-June 1961, p. 151-161 + 1 plate.

• The **Earth Crust Structure** of the West Siberia Lowland Central Regions by New Gravimetric Data – Work deals with the clarification of the character of change of the plutonic structure of the earth crust and specification of certain peculiarities of its structure for central regions of Irtysh. (*In Russian.*) Stroenie zemivoĭ kory tsentral'nykh raionov zapadno-sibirskoi nizmennosti po dannym gravimetrii. – R. F. Volodarskii. *Moscow, Universitet, Vestnik, Seriia IV, Geologiia,* v. 15, no. 5, 1960, p. 13-21.

• Certain Problems of **Plutonic Tectonics** – Analysis based on published literature. (*In Russian.*) Nekotorye voprosy glubinnoi tektoniki. – V. V. Belousov. *Moscow, Universitet, Vestnik, Seriia IV, Geologiia,* v. 15, no. 5, 1960, p. 3-12.

• The Birefrigence Dispersion, Chemical Composition and Structure of Some **Beryls** – Chemical composition and **structure** of beryls were determined. The study also showed that hexagonal structure of the beryl possesses an **anomalous monoclinic symmetry** character. This deviation from the norm is due to disturbances in the structure. (*In Russian.*) Dispersiia dvukhprelomleniia, khimicheskii sostav i struktura Berillov. – E. A. Kuznetsov and Li Chzhao-Lin. *Moscow, Universitet, Vestnik, Seriia IV, Geologiia,* v. 15, no. 6, 1960, p. 46-58.

Density in a **Planetary Exosphere** – Discussion of the Öpik-Singer theory of the density of a planetary exosphere. Concludes that the Öpik-Singer formula seems valid for the ballistic component of the exosphere; but for a complete description of the planetary exosphere, the ionized and bound-orbit components must also be included. – Jackson Herring and Herbert L. Kyle. *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-1042, July 1961, 5 pp. (TL570 Un3t Vis.)

• Geochemistry of **Tantalum** and Niobium of One of the Pegmatitic Siberian Deposits – Tantalum and **niobium** mainly are found in the form of minerals of the niobite-tantalite group. In as far as their chemical composition is concerned these minerals pertain to tantilite-niobites and niobite-tantalites. (*In Russian.*) K geochimii tantala i niobiia na odnom iz pegmatitovykh mestorozhdeniia Sibiri. – N. E. Sergeeva. *Moscow, Universitet, Vestnik, Seriia IV, Geologiia,* v. 15, no. 4, July-Aug. 1960, p. 29-35.

• **Thermoelectric Phenomena** in the Sun. I. Electrostatic Field in the Solar Corona – Possibility of the electrical current emergence in the **solar corona** due to the difference in the charges of inequally heated corona regions is considered. (*In Russian.*) Termoelektricheskie iavleniia na solntse. I. Elektrostaticheskoe pole v salnechnoi korone. – G. M. Shtilstein. *Astronomicheskii Zhurnal,* v. 38, no. 3, May-June 1961, p. 463-473.

• A Determination of the Mean Square Error of the Observable Number of Meteors Per Unit Time – An equation for the mean square error of observed meteor rate was derived and checked experimentally. A method for the preliminary selection of the activity maxima for the detection of possible **meteor showers** was considered. The method is based on the dispersion analysis. (*In Russian.*) Opredelenie srednei kvadraticheskoi oshibki chisla meteorov v edinitsu vremeni. – O. I. Bel'kovich. *Astronomicheskii Zhurnal,* v. 38, no. 3, May-June 1961, p. 532-535.

Tektites and Natural Satellites of the Earth – The attempts to put the theory of the derivation of tektites from showers like the Cyrillid shower in numerical form. For definiteness, the integrations are modeled on the australite problem. – John A. O'Keefe and Barbara E. Shute. *Aero/Space Engineering,* v. 20, July 1961, p. 26 + 3 pages.

• Aggregates, Cement, and Lime: Targets for Geology – Outlines some of the more practical aspects of **geology** relative to aggregates, **cement, and lime** to foster a broader application of geology on the one hand and possibly more efficient industrial operation on the other. – Gary R. Gates and Duncan J. McGregor. *Pit and Quarry,* v. 54, no. 1, July 1961, p. 193-198.

• Geology of the **Sea Floor** East of Guadalupe Island – A gently rolling surface of very soft folded sediment lies at the anomalously shallow deep-sea depth of 1900 fathoms. Sub-bottom echoes occur at a uniform depth of 6-8 meters over most of the area and photographs reveal organisms vigorously reworking much of the upper 10 centimeters of sediment. – Dale C. Krause. *Deep-Sea Research,* v. 8, no. 1, June 1961, p. 28-38 + 12 figures.

Field Tests Determine Potential Quantity, Quality of Ground Water Supply – Describes the methods, equipment, and computations used in field investigation of the available **ground water supply.** – John F. Hoffman. *Heating, Piping & Air Conditioning,* v. 33, Aug. 1961, p. 127-133.

• High Sensitivity Detection of **Naturally Occurring Radiocarbon.** I. Chemistry of the Counting Sample – Presents a means by which the entire counting solution (not including the small amounts of phosphors) can be synthesized from the sample to be dated. The solvent used is benzene, which is one of the most suitable materials for liquid scintillation counting since it contains 92% C and shows no scintillation quenching properties. – M. A. Tamers, J. J. Stipp, and J. Collier. *Geochimica et Cosmochimica Acta,* v. 24, nos. 3-4, July 1961, p. 266-276.

• Some Studies of Geomagnetic **Micropulsations** – Oscillations of the **geomagnetic field** with periods between 1 sec and a few min have been studied by means of large ground loops at Hobart, Adelaide, Camden, and Townsville, Australia. – R. A. Duncan. *Journal of Geophysical Research,* v. 66, no. 7, July 1961, p. 2087-2094.

• Long-Range Sound Transmission in the Arctic Ocean – Explosions of as small as 2 lb. of TNT have been detected in the Arctic Ocean at distances up to 1150 km. Hydrophones at depth

and geophones on the ice surface were used as listening devices in studies of **underwater sound transmission.** – Henry Kutschale. *Journal of Geophysical Research,* v. 66, no. 7, July 1961, p. 2189-2198.

• Review of **Carbon Cyanidation** – General review of recent developments. – Frank A. Seeton. *Mines Magazine,* v. 51, July 1961, p. 13-15.

• **Solar Emission** of High-Energy Particles – Life times of **high energy protons** in the chromospheric plasma are evaluated. Possible mechanisms are also cited. (*In Russian.*) K voprosu ob emissii solntsem vysokoenergicheckikh chastits. – A. A. Stepanian and B. M. Vladimirskii. *Astronomicheskii Zhurnal,* v. 38, no. 3, May-June 1961, p. 439-442.

The **Solar Spectrum** in **Space** – Richard Tousey. *Astronautics,* v. 6, July 1961, p. 32 + 3 pages.

• The Production Rate of **Natural Tritium** – Evaluates the **production rate** in the pre-thermonuclear epoch. The global mean production rate, calculated from the geochemical inventory, is found to be 0.5 ± 0.3 atoms T/cm² sec. This value is three to four times smaller than values found previously. – Harmon Craig and Devendra Lal. *Tellus,* v. 13, no. 1, Feb. 1961, p. 85-105.

Advances in **Geophysics** – Covers problems dealing with the heat balance of the atmosphere, balloon exploration of the atmosphere, ozone, solar terrestrial relations, ionization in space, paleomagnetism, and other topics now in the limelight of geophysical interest. – H. E. Landsberg and J. van Mieghem, editors. v. VII. 333 pp. 1961. Academic Press, New York. (QC806 Ad95 Vis.)

• Occurrence of **Radioactive Fluoritic Sandstone,** Wet Mountains, Colorado – Dakota sandstone with a fluorite cement containing Th, U, and Zr occurs in the proximity of a Tertiary hypabyssal rhyolite stock at the southern end of the Wet Mountains. – Robert E. Boyer. *Economic Geology,* v. 56, no. 4, June-July 1961, p. 780-783.

• The Nature of **Dust Collected at High Altitudes** – Dust was collected at altitudes above 40,000 ft by devices mounted on airplanes or balloons. Individual particles were analyzed for the elements, Fe, Ni, Co, Mn, Cr, Cu, and Zn with an electron-probe microanalyzer, and for Al and Co by neutron activation. – E. I. Fireman and G. A. Kistner. *Geochimica et Cosmochimica Acta,* v. 24, nos. 1-2, June 1961, p. 10-22 + 2 plates.

• The Record in the Meteorites. IV. Origin of Diamonds in **Iron Meteorites** – A number of **diamond-bearing** Canyon Diablo specimens have been investigated in order to determine whether the diamonds were produced under high gravitational pressures in a meteorite parent body, or upon impact with the earth. – Michael E. Lipschutz and Edward Anders. *Geochimica et Cosmochimica Acta,* v. 24, nos. 1-2, June 1961, p. 83-105 + 6 plates.

• Laboratory Measurement of the Velocity of Sound in Consolidated Sedimentary Rocks – **Measurement of ultra-sonic waves in rocks** were made in a logging laboratory. Dry sandstones and limestones successively saturated by salt water and crude oil were examined; part of the resulting experimental data are described. (*In French.*) Mesure en laboratoire de la vitesse du son dans les roches sédimentaires consolidées. – J. Ladefroux. *Institut Français du Pétrole, Revue et Annales des Combustibles Liquides,* v. 16, Apr. 1961, p. 367-381.

• How New **Foaming Agents** Are Aiding **Air/Gas Drilling** – Foaming agents have been developed for effective use in the presence of a wide range of contaminants. – J. L. Lummus and B. V. Randall. *World Oil,* v. 153, July 1961, p. 57-62.

• How **Lithologic Zoning of Dolomites** Helps Find Oil – Porous, permeable facies are often capped by tight dolomite rock; better core descriptions are urged. – John P. Hobson, Jr. *World Oil,* v. 153, July 1961, p. 63-67.

Satellite Environment Handbook – Structure of the upper atmosphere; structure of the ionosphere; penetrating radiation; micrometeorites; thermal radiation from the earth; geomagnetism. – Francis S. Johnson, editor. 155 pp. 1961. Stanford University Press, Stanford, Calif. (QC879 J63s)

• Giant **Radio-Telescope** Will Tune-In Outer Space – Some difficult **welding problems** encountered when fabricating the support structure for this 140-ft-diameter dish-type "super ear", designed to pull in radio waves from outer space. – *Welding Engineer*, v. 46, July 1961, p. 35-37.

Slim Holes Can Cut Hard-Rock Drilling Cost – Field tests made by a drilling contractor show that the slim hole is not just a soft-rock method. It can save money in tougher **drilling,** like West Texas and New Mexico. – Frank M. Pool. *Oil and Gas Journal*, v. 59, no. 29, July 17, 1961, p. 81-83.

Gravity-Magnetics Can Be an Effective Tool for **Oil Finders** – R. A. Geyer. *Oil and Gas Journal*, v. 59, no. 29, July 17, 1961, p. 126-128.

How Sand Grains Tell Where to Drill Next – Secret of the method is contained in a machine which measures electric properties in a section of a core sample and shows the **direction in which** the egg-shaped microscopic **sand grains lay.** – *Oil and Gas Journal*, v. 59, no. 30, July 24, 1961, p. 40-41.

Recovering **Attic Oil** – Gas is injected into the formation through the highest producing well, forming an artificial gas cap. Oil is forced downdip, where it can be recovered through the same well used for gas injection. – L. O. Franklin, W. A. Koederitz, and Donald Walker. *Oil and Gas Journal*, v. 59, no. 30, July 24, 1961, p. 65-70.

• The **Solubility of Quartz** in Water at High Temperatures and High Pressures – The present values are generally lower than those already published, and the maximum value for the discrepancy is about 10% up to 500 C and 900 atm. – Shigeto Kitahara. *Review of Physical Chemistry of Japan*, v. 30, no. 2, 1960, p. 109-114.

• **Shearing Tests** of Sodium Chloride Crystals at Room Temperature and at 300°C – Plastic shearing tests, at room temperature, **on dry NaCl** crystals, have shown a plastic shear of 50% and over. (*In German.*) Schubversuche an Natriumchlorid-Kristallen bei Raumtemperatur und bei 300°C. – Ludwig Graf and Jürgen Budke. *Zeitschrift für Metallkunde*, v. 52, June 1961, p. 397-410.

• Geological Significance of Fracture Traces – **Fracture traces,** as now mapped in a variety of landscapes, are parallel or subparallel to joints in areas of flat or very gently folded rocks but are not parallel to the dominant joint sets in folded rocks. – Laurence H. Lattman and Richard H. Matzke. *Photogrammetric Engineering*, v. 27, no. 3, June 1961, p. 435-438.

Deuteronomy. Synthesis of Deuterons and the Light Nuclei During the Early History **of the Solar System** – Abundances in terrestrial and meteoritic matter indicate that the synthesis of deuterons and of the isotopes of Li, Be, and B occurred during an intermediate stage in the early history of the solar system. In this intermediate stage, the planetary material had become largely separated, but not completely, from the H which was the main constituent of primitive solar material. Appropriate physical conditions were satisfied by solid planetesimals, with dimensions of the order of 10 m, and consisting of silicates and oxides of the metals embedded in an icy matrix. The synthesis occurred through spallation and neutron reactions induced in the outer layers of the planetesimals by the bombardment of high-energy charged particles accelerated in magnetic flares at the surface of the condensing sun. The importance of the (n,α) reactions on Li^6 and B^{10} is indicated by the relatively low abundances of these two nuclei. Anomalous abundances of Xe^{129} and Ag^{107} observed in meteorites can be attributed to the decay of radioactive I^{129} and Pd^{107} produced in the planetesimals. The interval between the irradiation of the small planetesimals and the formation of large bodies in the solar system could not have exceeded 10^7 to 10^8 years. – William A. Fowler, Jesse L. Greenstein, and Fred Hoyle. *American Journal of Physics*, v. 29, no. 7, July 1961, p. 393-403.

• **Photointerpretation** of the Lunar Surface – A description of the present day photographs of the **lunar surface.** Techniques for photographing and some interpretations of the results are given. – Robert J. Hackman. *Photogrammetric Engineering*, v. 27, no. 3, June 1961, p. 377-386 + 1 plate.

• A Contribution to the Problem of the **Earth Expansion** – Limited and wider expansion theories are studied on the basis of the gap systems of the earth surface, of Binge's interpretation of the volcano systems, of the Dirac hypothesis and paleoclimatology, and of the problem of the continents and oceans. (*In German.*) Zum Problem der Erdexpansion. – P. Jordan. *Naturwissenschaften*, v. 48, no. 11, June 1961, p. 417-425.

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Internal Waves in the **Ocean** – Carl Eckart. *Physics of Fluids*, v. 4, no. 7, July 1961, p. 791-799.

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Underground **Subsidence** – An underground cavity of horizontal cross-section is assumed to exist at some depth below the surface. At the time t = O **rock** above the cavity fails and completely fills out the cavity with expanded broken material. With passing time, the broken rock consolidates and subsidence proceeds continuously upward in a vertical shaft. The phenomenon is one-dimensional and the problem consists of finding the displacement and the velocity with which the front of the subsidence (wave front) moves upward as a function of the time and of the rock properties. – Andrew W. Jenike and Tadeusz Leser. *Utah Engineering Experiment Station, Bulletin No.* 114, Apr. 1961, 19 pp. (QE169 Ut1.82b Vis.)

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Physical **Oceanography** – Involves physical oceanography only, the scientific progress of which has been especially fast during the last 50 years owing to technical improvement of the working methods used on oceanographic research vessels and also to the extensive widening of our physical and chemical views about the phenomena occurring in the sea. – Albert Defant. v. I, 729 pp.; v. II, 598 pp. 1961. Pergamon Press, New York. (GC11 D36p)

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Project **Mohole:** Full of Promise for Offshore Oil Hunters and Deep Drillers – A free gift of research and development is the oil industry's likely harvest from scientists' attempts to drill Mohole. In this drive to push a hole deep enough to sample the earth's mantle rocks, there are certain to be valuable lessons in **deep-drilling techniques** and in offshore-operation methods. Practice holes recently completed were resoundingly successful. – Ed McGhee. *Oil and Gas Journal*, v. 59, no. 28, July 10, 1961, p. 108-113.

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• The **Solubility** Equilibrium and the Rate of Solution of **Quartz** in Water at High Temperatures and High Pressures – The reasonable chemical equilibrium for solution of quartz in water under supercritical conditions seems to be represented by the following equation: $SiO_2(quartz) + 2H_2O(gas) \rightleftharpoons Si(OH)_4(gas)$. A rate equation was found to be applied to the solution of quartz under supercritical conditions. The rate of solution was accelerated by NaCl added to water. – Shigeto Kitahara. *Review of Physical Chemistry of Japan*, v. 30, no. 2, 1960, p. 122-130.

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GRAPHIC ARTS

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• Environmental Effects of Supersonic and Hypersonic Speeds on **Aerial Photography** – Boundary layers and shock waves; window curvature caused by aerodynamic heating; turbulent boundary layers; Rayleigh scattering; air luminosity at **hypersonic speeds.** – Jack N. Nielsen and Frederick K. Goodwin. *Photogrammetric Engineering*, v. 27, no. 3, June 1961, p. 427- 435.

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• NavScan: A Dual Purpose **Panoramic Camera** – Designed to produce highly resolved and dimensionally precise photographic reproductions of panoramic views. The optico-mechanical design principles of the **NavScan** are compatible for both quality and metrical photography, without a compromise of either type. – Gomer T. McNeil. *Photogrammetric Engineering*, v. 27, no. 3, June 1961, p. 407-414.

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HUMAN FACTORS

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• The Selection of Employees in Industry – The problem of this investigation was the development of a weighted system for personal data and psychological test scores in the selection of loopers in a knitting mill, to reduce turnover and maximize

productivity. The results of this investigation, and many others being currently conducted, show that a weighted system can be of real value in the **selection of personnel.** – D. J. Moffie. *Archives of Environmental Health*, v. 3, no. 1, July 1961, p. 94-99.

• A Comparison of Vertical and Horizontal Arrangements of **Alpha-Numeric Material**--Experiment I – The objective of this study was to determine the relative **effectiveness of visual displays** containing α-numeric material displayed in vertical and horizontal arrangements. Variables included in the experimental design were: types of arrangement of display material, density of material, composition of material, and operator tasks. The major finding in the study was the non-significance of the arrangement variable. It was found that, for all practical purposes, the differential effects of vertical and horizontal arrangement of α-numeric materials on operator performance are negligible. – John L. Coffey. *Human Factors*, v. 3, no. 2, July 1961, p. 93-98.

• An Evaluation of Formats for **Graphic Trend Displays**--Experiment II – This study was designed to determine which of three types of trend formats results in superior performance for a task requiring the subject to make **complex decisions.** Three commonly used formats were included in the study: line type, vertical-bar type, and horizontal-bar type. Two secondary independent variables were: number of time points and amount of missing data. Results of the study indicate that preference should be given to line-type graphs, followed closely by the vertical-bar type. A secondary finding was that irrelevant points and missing data on graphic trend displays represent important factors in the degradation of operator performance. – Howard G. Schutz. *Human Factors*, v. 3, no. 2, July 1961, p. 99-107.

• An Evaluation of Methods for Presentation of **Graphic Multiple Trends**--Experiment III – The primary objective of this study was to determine the effect of multiple-line versus multiple-graph presentation of trend-type displays on **operator performance.** Four types of lines having low confusability were determined experimentally from a sample of 25 lines. The primary variable was single-graph, multiple-line presentation versus multiple-graph single-line presentation. Other variables included in this study were: number of lines, degree of confusion among lines, coding of lines, and two operator tasks: point-reading and comparing. It was found that for the point-reading task, either type of display is acceptable, but for the comparing task, the multiple-line display is much superior to the multiple-graph display. Moreover, the use of color coding for the graph lines tended to improve performance slightly. – Howard G. Schutz. *Human Factors*, v. 3, no. 2, July 1961, p. 108-119.

• An Evaluation of Five Different **Abstract Coding Methods**--Experiment IV – The purpose of this study was to ascertain the relative effectiveness of selected abstract coding methods, based upon their effects on various operator tasks. Five different coding methods were selected: numerical, letter, geometric shape, color, and configuration. Secondary variables included in the study were target density, number of code levels, and **operator tasks.** It was found that numeral coding and color coding are the two superior coding methods. If greater emphasis is to be placed on identifying symbols, numerical coding is superior to color coding. No significant differences were found, however, between numeral coding and color coding for the remaining operator tasks: locating, counting, comparing, and verifying. – William D. Hitt. *Human Factors*, v. 3, no. 2, July 1961, p. 120-130.

• An Evaluation of the Effect of Selected Combinations of Target and Background Coding on **Map-Reading Performance**--Experiment V – The objective of this study was to determine the relative effectiveness of selected **target-background coding** combinations. Three target codes were: color, number and enclosed shape. Five types of background were: all white, solid gray, five shades of gray, five pastel hues, and five different patterns. These target-background coding combinations were evaluated under eight different complexity conditions and for five different operator tasks. The major findings in this study were: no significant differences were found in background coding, numeral coding is superior for the "identifying" task, and color coding is superior for the "locating" and "counting" tasks. – Charlotte A. Christner and Horace W. Ray. *Human Factors*, v. 3, no. 2, July 1961, p. 131-146.

• Development of Design Criteria for **Intelligence Display Formats** – A broad research program to develop design criteria for intelligence display formats is outlined and the general findings of the program are discussed. Five specific areas of investigation are selected for study: a comparison of vertical and horizontal arrangements of **α-numeric material,** an evaluation of formats for trend displays, an evaluation of methods for presentation of graphic multiple trends, an evaluation of five abstract coding methods, and an evaluation of the effect of selected combinations of target and background coding on **map reading performance.** – W. D. Hitt, H. G. Schutz, C. A. Christner, H. W. Ray, and L. J. Coffey. *Human Factors*, v. 3, no. 2, July 1961, p. 86-92.

INFORMATION RESEARCH

Scientific Thinking and **Scientific Writing** – Emphasizes integrating logical and scientific methods with the actual organization of scientific writing. Considers expository organization as a function of **scientific thinking.** – Martin S. Peterson. 215 pp. 1961. Reinhold Publishing Corp., New York. (P7 P44s)

Instant Information – **Information retrieval** from an **economic** viewpoint. – *Machine Design*, v. 33, July 20, 1961, p. 24-26.

U.S. Organizations, Particularly in the Chemical Field, Use Advanced **Information Retrieval** on Expanding Scale – Describes how chemical companies and other organizations are using **advanced methods** to locate needed information in company documents, published reports, and other sources. – *Chemical & Engineering News*, v. 39, no. 30, July 24, 1961, p. 90 + 8 pages.

Information Retrieval Answers Your Question – In 18 millionths of a second, Western Reserve plucks an abstract from its **taped library** of 65,000 chemical and metallurgical documents. The computer--and know-how--are available from GE. – *Chemical Engineering*, v. 68, July 24, 1961, p. 68 + 1 page.

Storage and Retrieval of **Biological Information** – Discusses need for information **storage and retrieval systems.** The magnitude of literature is cited as a need for a retrieval system. – G. C. Ainsworth. *Nature*, v. 191, July 1, 1961, p. 12-14.

Science Information Personnel – Delineates a new profession of information combining science, librarianship, and foreign language. – Leonard Cohan and Kenneth Craven. 74 pp. 1961. Science Information, New York. (Q181 C66s)

Seeking New Ways Out of the **Literature Clutter** – New developments signify progress on one of technology's toughest problems. The advances--mainly modifications of programs begun some time ago--range from improved **abstracting systems** to more flexible **chemical nomenclature plans.** – *Chemical Week*, v. 89, no. 1, July 8, 1961, p. 75 + 3 pages.

• **Technical Writing** From the Spoken Word – Brings out the importance of the technical writer being a good listener. – Meta Ellis. *STWP Review*, v. 8, no. 3, July 1961, p. 12-13.

• Patterns of **Word Formation** With Special Application to **Technical Terms** – The use of technical words. How some of the currently used technical words were derived. – Frank R. Smith. *STWP Review*, v. 8, no. 3, July 1961, p. 8-11.

A Guide to **Technical Specifications** – For effective control of the flow of technical information into and out of a company. – A. J. Fitzgerald and Rowan Glie. *Machine Design*, v. 33, July 6, 1961, p. 112-117.

Science in **Writing** – A selection of passages from the writings of scientific authors, with notes, and a section on the writing of **scientific prose.** – T. R. Henn. 248 pp. 1961. The MacMillan Company, New York. (Q209 H39s)

• **Information Services** – Some suggestions regarding the **function and operation** of information services. – Isabelle H. Robertson. *Royal Australian Chemical Institute, Proceedings*, v. 28, May 1961, p. 199-207.

INSTRUMENTATION

Thermocouples for **Ultrahigh Temperatures** – Three new **thermocouples** have been devised for measuring temperatures in the 3000 to 5000 F range. Of these, Pt-30% Rh/Pt-6% Rh and Ir/Ir-Rh are useful to about 3700 F and W/W-26% Re is useful to 4200 F. Better heat insulators are expected to increase the range of the latter combination to 5000 F. – J. C. Lachman. *Metal Progress*, v. 80, no. 1, July 1961, p. 73-76.

Effects of Numerical Aperture on Contrast in Ordinary **Microscopy** – Experiments in which the **numerical apertures** of the objective and condenser of an ordinary microscope are reduced progressively and alternately in a systematic manner are described as regards contrast in the images of nonabsorbing particles that differ slightly from their surrounding medium in optical path. The observed **contrast** remains poor as the numerical apertures of the objective and condenser are reduced by means of variable diaphragms such that the ratio *s* of the numerical aperture of the condenser to that of the objective is held at unity. The observed contrast in the images of platelike particles tends toward similarity for a given value of *s* as the size of particle is increased. The various observations are interpreted theoretically and found to be in qualitative agreement with theory. Conditions under which distributions of irradiance in the images of different platelike particles become similar are formulated for in-focus and out-of-focus image planes. Knowledge of these conditions leads to improved understanding of the effects of numerical aperture on contrast in the image. – Harold Osterberg and Luther W. Smith. *Optical Society of America, Journal*, v. 51, July 1961, p. 709-714.

An Automatic Recording **Low-Temperature Dilatometer** – Describes apparatus and the experimental technique used in making a run. The specimen temperature is recorded in millivolts by a thermocouple connected to the Y-component of an X-Y strip-chart recorder, while the change in specimen length is simultaneously recorded by a linear variable differential transformer connected to the X-component. – K. A. Gschneider, Jr., R. R. McDonald, and R. O. Elliott. *U. S. Atomic Energy Commisison, LA-2500*, Dec. 1960, 18 pp. (UF767 U3La Contin.)

Photodetecting Instrument With **Flat Wavelength Response** – Photosensitive instruments which measure absolute irradiance in four spectral bands (2000-2500 A. 2500-4000 A, 4000-5000 A, and 5000-10,000 A) are described. One instrument is used to cover each range. The basic unit is a prism-type spectrometer that weighs 2 lb. and measures 1-½ by 15 in. This compact packaging is achieved by the use of a unique single prism that produces a straight-through optical axis. The spectral cutoffs are sharp and the electrical output is constant for a given flux of any wavelength distribtuion within the spectral passband. The passband with sharp wavelength cutoffs and a flat response versus wavelength is accomplished by the use of a mask with variable aperture placed in the focal plane. Microsecond response time is obtained through the use of a ¾ in. phototube detector which is used as a photomultiplier or photodiode, depending upon sensitivity requirements. – Paul M. McPherson, Nathan Sclar, Bernard R. Linden, Willem Brouwer, and A. T. Stair, Jr. *Optical Society of America, Journal*, v. 51, July 1961, p. 767-773.

• **Plastic-Replica Mirror Segments** for a **Solar Furnace** – Concludes that, with careful washing when necessary to remove accumulated dirt, reflectance is well maintained at about 80%. The present process for replicating surfaces should be economically attractive in several fields where amounts of this order are expended on producing single surfaces. – J. Bolin, C. J. Tenukest, and C. J. Milner. *Solar Energy*, v. 5, no. 3, July-Sept., 1961, p. 99-102.

• Tables of Wavenumbers for the Calibration of **Infra-Red Spectrometers** – Gives tables for the calibration of grating spectrometers in the range 4300-600 cm^{-1}. **Wavenumbers** are listed for the calibration of prism and small grating spectrometers (resolution 0.5-10 cm^{-1}) in the range 3950-600 cm^{-1}. – *Pure and Applied Chemistry*, v. 1, no. 4, 1961, 166 pp.

A Photoelectric-Recording **Raman Apparatus** – A **photoelectric** Raman apparatus assembled at the laboratory is described. Noteworthy features include the type of monochromator used,

the specially designed optical arrangement, and the versatility of the instrument. Samples in the liquid and solid states can be investigated at temperatures ranging from about +150 C to −195 C. A number of spectra are given to demonstrate the performance of the instrument. – Ann Werbin and Thure Anderson. *U. S. Atomic Energy Commission, UCRL-6309*, Mar. 14, 1961, 29 pp.

1960 Proceedings of Instrument Society of America 15th Annual **Instrument-Automation Conference** and Exhibit. I-II – Preprints of some 100 papers have been prepared in bound form primarily for the convenience of libraries and instrumentation reference collections. – v. XV. Sections individually paged. Sept. 26-30, 1960. Instrument Society of America, Pittsburgh. (Q184 In7p Vis.)

Design Criteria For **Printed Circuit** Boards – Sets forth the principles of good printed **wiring board design** practice, proven by test results and practical experience to yield the simplest and most reliable product at minimum cost. – *U. S. Atomic Energy Commission, SCDR-280-60*, Nov. 1960, 65 pp. (UF767 Un3.1sd Contin.)

An Accurate Shock Calibrator for **Accelerometers** – A pendulum device using a force transducer is to be an accurate **shock calibrator** for accelerometers. – David F. Palmer. *U. S. Atomic Energy Commission, SCTM-96-61(73)*, Apr. 1961, 15 pp. (UF767 Un3.1sct Contin.)

LUBRICATION AND FRICTION

• **Wear** of Materials--Impact on Design Failure – The mechanisms and the means for minimizing the undesirable effects of wear. – Harold E. Barkan. *Electro-Technology*, v. 68, no. 1, July 1961, p. 95-102.

• The **Lubrication of Nuclear Power Plants** – Deals with the origin and beneficial application of nuclear power, and with the many lubrication problems that are being solved. – R. S. Barnett. *NLGI Spokesman*, v. 25, no. 4, July 1961, p. 92-106.

Survey of **Materials for High-Temperature Bearing and Sliding** Applications – Compares thermal, physical, mechanical, and chemical properties of Mo and its alloys, W, Cr, Cb, and Ta; the Fe-, Ni-, and Co-, base superalloys; and cermets, ceramics, and graphite. – M. F. Amateau, D. W. Nicholson, and W. A. Glaeser. *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 106, May 12, 1961, 67 pp. + appendix. (TN799 B32.2d Contin.)

• A Study of **Friction and Wear** Phenomena Occuring at High (Up to 815° C) or Low (-250° C) Temperatures – Discusses friction and wear phenomena occuring at **extremely high or low temperatures,** in environments radically different from the ordinary atmosphere, and in the field of aeronautics and space science. (*In French.*) Étude du frottement et de l'usure a des températures élevées (jusqu'a 815° C) ou très basses (250° C). – E. Bisson. *Institut Français du Pétrole, Revue et Annales des Combustibles Liquides*, v. 16, Apr. 1961, p. 485-508.

• **Re-Refined Lubricating Oils** for Railroads – Commercial refiners make specification **journal box oil for railroads** from used automotive crankcase oils. These oils have been drained because of contamination--the major part is not "worn out." Stable portions of the oil are recovered by re-refining, the unstable parts and contaminants are discarded. – A. M. Crittenden. *Lubrication Engineering*, v. 17, July 1961, p. 330-333.

MECHANICAL ENGINEERING

Critical Speeds of **Coupled Machines** – A quick approximate method for determining the **critical speed,** or natural lateral frequency, of a coupled system. – T. H. Nash, V. L. Kenyon, and J. N. MacDuff. *Machine Design*, v. 33, Aug. 17, 1961, p. 143-149.

Nomograms for Determining **Radii of Gyration** – A data sheet for determining k^2 where multiple dimensions occur. – Hans W. Smith. *Machine Design*, v. 33, Aug. 17, 1961, p. 173-177.

METALLURGY

The Stability and Properties of **Alloy Steels at Elevated Temperatures,** a Literature Survey – Covers crystal structure and phase equilibria, identification, mechanical properties, welds, and corrision. – M. T. Simnad. *U. S. Atomic Energy Commission, GAMD-1769*, Nov. 21, 1960, 78 pp. (UF767 Un3.1gam Contin.)

• Wrought **Lead-Cadmium-Nickel Alloys** – A Pb-base alloy has been developed which is strengthened by two separate alloying methods: solid-solution hardening and dispersion hardening. Solution hardening addition, 1.5% Cd, improved tensile strength and resistance to slow strain-rate fatigue failure. The dispersion hardening addition, 0.2% Ni, improved creep resistance. Neither addition impaired corrosion resistance. The studies responsible for the final alloy selection are described, and the results of extensive evaluation of laboratory and pilot-plant alloys are reported. – D. N. Williams, K. R. Grube, and R. I. Jaffee. *American Society for Metals, Transactions*, v. 54, no. 1, Mar. 1961, p. 96-105.

Evolution of Ultrahigh-Strength, Hardenable Steels for **Solid-Propellant Rocket-Motor Cases** – Discusses the evolution of the current roster of **special steels** and shows their relationship to the older, more familiar steels. The evolution is traced from AISI 4130, through AISI 4340 and its modifications and includes the 5Cr-Mo-V steels (hot-work die steels). The discussion covers the influence of composition on performance and properties, response to tempering and the effects of tempering, and the differences and similarities among the steels. Also included are comments on such matters as fabrication, welding, heat treating, notch sensitivity, decarburization, high-temperature properties, and the benefits of vacuum melting. – H. J. Hucek, A. R. Elsea, and A. M. Hall. *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 154, May 25, 1961, 42 pp. (TN799.T5 B32.7t Vis.)

Two-Phase Permalloy for **High-Speed Switching** – The addition of Au to Permalloy has made it possible to precipitate a second phase in the alloy. As a result it is possible to control the coercive force and, to some degree, the threshold for rotational flux reversal, by appropriate heat treatments. On this basis a series of alloys have been developed by adding 2-14% Au to **Permalloy.** Some of these alloys have switching times approximately four times faster than that of the standard Permalloy composition. The switching time is defined as the reversal time at twice the coercive force. – E. A. Nesbitt and E. M. Gyorgy. *Journal of Applied Physics*, v. 32, July 1961, p. 1305-1308.

Polygonization in Bent Zinc Crystals – High-purity **zinc crystals** were grown from the melt by the soft mold technique, and bent in such a way that [0110] was parallel to the bending axis and the [2110] slip direction enclosed approximately 45° with the bending radius. A dislocation etching technique was developed, which reveals the edge dislocations introduced on bending, without the necessity of decoration. – P. P. Sinha and Paul A. Beck. *Journal of Applied Physics*, v. 32, July 1961, p. 1222-1226.

The **Effects of Alloying Elements** in Titanium. Volume B. Physical and Chemical Properties, Deformation and Transformation Characteristics – Data on the physical, electrical, and chemical properties of **titanium alloys** are reviewed. Information is presented on the diffusion of interstitial and substitutional elements. The effects of alloying additions on deformation, recovery, recrystallization, and grain-growth characteristics are analyzed, and transformations are discussed in terms of the reaction kinetics. – D. J. Maykuth, F. C. Holden, D. N. Williams, H. R. Ogden, and R. I. Jaffee. *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 136B, May 29, 1961, 150 pp. (TN799.T5 B32.7t Vis.)

Physical Chemistry of Process Metallurgy. I-II – An international symposium sponsored by the American Institute of Mining, Metallurgical and Petroleum Engineers, Pittsburgh, Pa. Apr. 27-May 1, 1959. Papers cover **refining processes, smelting reactions, slags,** and **properties** of various metals and alloys. – George R. St. Pierre, editor. v. VII-VIII. I. 644 pp.; II. 727 pp. 1961. Interscience Publishers, New York. (TNI P56)

• Superlight **Lithium Alloys** – Ternary Li-Mg-Al alloys with 7-15% Al, 15-25% Li and 60-80% Mg can be recommended as **structural alloys.** They may be used in different fields of technique where the working specifications require a decrease of the specific weight of the structures. Alloys with specific weight below the unit can be used as pipe fillers to impart more rigidity, while lowering the specific weight. (*In Russian.*) Sverkhlegkie litievye splavy. – E. M. Savitskiĭ, V. F. Terehova, and O. P. Naumkin. *Tsvetnye Metally*, v. 35, no. 5, May 1961, p. 58-61.

Our new format should help you scan the page quickly. Boldface clue words identify subject matter. Titles appear unchanged at the beginning of each abstract.

Contemporary Problems of Metallurgy – Translations of some 40 papers in the fields of metallurgy of **iron and steel,** metallurgy of **nonferrous metals, working of metal by pressure,** and the science of metals. – A. M. Samarin, editor. 530 pp. 1960. Consultants Bureau, New York. (TN607 Ak13str)

• The Fabrication and Use of Some **Nickel Alloys** – K. H. Belcher. *Australian Institute of Metals, Journal*, v. 6, no. 2, May 1961, p. 150-159.

Tantalum Alloys for **Elevated-Temperature Service** – Early results of a **tantalum alloy** development program have shown that high hot-strength properties can be attained while maintaining low-temperature toughness and ductility. – F. F. Schmidt, D. J. Maykuth, and H. R. Ogden. *Journal of Metals*, v. 13, July 1961, p. 487-489.

The Structure and Associated Properties of an **Age Hardening Copper Alloy** – The electrical, mechanical, and corrosion cracking properties of an age-hardenable Cu-Ni-Si alloy were studied over a range of time, temperature, and deformation states for the purpose of determining the relationship between the properties and the structural state. The precipitate was identified as Ni_3Si, and the sites of preferred precipitation were located by electron microscope studies of the structures developed by various combinations of heat treatment and plastic deformation. An extreme form of deformation banding was observed in the aged alloy that results in high strain concentration in bands lying parallel to {111} planes. These bands are the structural paths along which transcrystalline cracks propagate in the deformed alloy. The observations provide a basis for a general mechanism of transgranular corrosion cracking of face-centered cubic alloys in terms of stacking fault probability. – W. D. Robertson, E. G. Grenier, and V. F. Nole. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 503-512.

Review of Recent Developments in the Technology of **Columbium** and **Tantalum** – Briefly reviews information received by DMIC during the period from Apr.-June, 1961. Covers alloy development, heat treatment, and properties. – E. S. Bartlett and F. F. Schmidt. *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 115, July 7, 1961, 4 pp. (TN799 B32.2d Contin.)

Review of Recent Developments in the Technology of **Molybdenum** and **Molybdenum-Base Alloys** – Discusses newly-reported data on arc melting, fabrication, properties, and structure. – J. A. Houck. *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 114, July 5, 1961, 3 pp. (TN799 B32.2d Contin.)

• **Tantalum** – Studies the **electron beam melting** of Ta in detail and explains the effects of nonmetallic impurities and the treatment and use of Ta in the chemical industry and in

electrical and high temperature technique. (*In German.*) Tantal. – E. Erben and R. Lesser. *Metall*, v. 15, July 1961, p. 679-686.

A review of Recent Developments in **Titanium and Titanium Alloy** Technology – Summarizes new developments in titanium metallurgy that became available to DMIC during the period from Mar. through May 1961, on Ti-13V-11Cr-3Al, Ti-8Al-1Mo-1Mo-1V, Ti-8Al-10V, and unalloyed Ti. – R. A. Wood. *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 113, July 3, 1961, 4 pp. (TN799 B32.2d Contin.)

Design Considerations in the Use of 5000 Series **Aluminum Alloys** – The general nature of the series of aluminum alloys containing Mg as the main alloying element recommends specific alloys and tempers for each form; and indicates aspects of **stress-corrosion cracking, arc welding,** and **forming** which should be considered. – C. H. Maak. *U. S. Atomic Energy Commission, SCDR-243-60*, Mar. 1961, 21 pp. (UF767 (Un3.1sd Contin.)

Review of Recent Developments in the Technology of **High-Strength Stainless Steels** – Gives recent data on processing of wide sheet to closer tolerances, study of crack strength and propagation, and heat treatment and properties of newer steels. – D. A. Roberts. *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 117, July 14, 1961, 3 pp. (TN799 B32.2d Contin.)

METALS—CORROSION

• The Influence of Alloying Elements and Other Impurities on the Corrosion Resistance of **Wrought Aluminium** – Discusses the influence of the principal alloying constituents and of small amounts of either deliberate or accidental admixtures on the resistance to **weathering** and to corrosion by **sea-water.** The influence of structure, degree of deformation and the geometrical form of the metal surface are also discussed. The following approximate grading is made, in descending order of corrosion resistance: Al 99.98, AlMg = AlMgMn = AlMn, Al 99.5, AlMgSi, AlSi, AlZnMg, AlZnMgCu = AlCuMg. (*In German.*) Der Einfluss von Legierungselementen und sonstigen Beimengungen auf das Korrosionsverhalten von gekneteten Aluminiumwerkstoffen. – H. Vosskühler and H. Zeiger. *Aluminium (Dusseldorf)*, v. 37, July 1961, p. 424-429.

• The Corrosion of **Aluminium** – The corrosion of Al at room temperature has been investigated in nine decinormal solutions over the pH range 2.0–12.0. Corrosion was dependent more on the nature of the anion than on the pH of the solution. It is suggested that when Al, carrying its air-formed film, is immersed in a **solution** in the presence of oxygen, the film breaks down and a small corrosion commences to flow. In the absence of chlorides, and similar ions, film repair can take place and the behavior of the Al is controlled by the relative rates of film repair and film breakdown. In the presence of chlorides film repair does not occur and once corrosion has been initiated by film breakdown it proceeds apace. If initiation is suppressed by saturating the solution with aluminum oxide, corrosion is inhibited. – K. F. Lorking and J. E. O. Mayne. *Journal of Applied Chemistry*, v. 11, May 1961, p. 170-180.

Theory and Application of **Deep Ground Anode Beds** – Discusses advantages of deep ground bed anode installations in comparison with surface ground beds. Defines deep bed installation as an isolated current source 200 feet or more below surface of ground. Explains that deep well anode systems can decrease anodic interference, but do not insure against anodic intereference and do not affect cathodic interference problems. Also discusses deep ground bed's efficient use of current. Explains how cost savings can be made through use of deep ground beds. – Joe F. Tatum. *Corrosion*, v. 17, Aug. 1961, p. 26 + 4 pages.

Do Jet Fuel **Bacteria** Cause Slime, Corrosion? – Rising incidence of corrosion and filter fouling in **jet fueling systems** is causing increasing concern. Big aim of current research: determine most effective attack. – D. H. Stormont. *Oil and Gas Journal*, v. 59, no. 27, July 3, 1961, p. 82-84.

Corrosion Associated With Fluorination in the Oak Ridge National Laboratory Fluoride Volatility Process – This report evaluates chemical corrosion on reaction vessels and equipment used during the fluorination of **fused-salt fuels** and subsequent associated operations in the Oak Ridge National Laboratory (ORNL) Fluoride Volatility Process. From a corrosion standpoint, the fluorination vessel in the Volatility Pilot Plant continues to be the most vulnerable to attack due to the nature of the contained environment and the high temperature necessary for fluorination. The continued use of L nickel for the fluorination vessel does not appear prohibitive for batch operations only due to the present high value of the pilot plant's product. At present, the only guarantee for improved service life for **nickel fluorinators** seems to be utilization of the lowest practical temperature. Although not conclusively proven for the fluorination vessels, reduction of sulfur contamination and the ensuring of a uniform, small-grain size in the vessels may improve vessel performance. For long-time fluorinator integrity, selection or development of a new material of construction, the use of salts with lower melting points, or the use of a cold wall vessel seems necessary. – A. P. Litman and A. E. Goldman. *U. S. Atomic Energy Commission, ORNL-2832*, June 19, 1961, 188 pp.

Oxidation of **Iron-Chromium Alloys** at 750-1025 C – The rates of **oxidation** of iron alloys containing 0.2 to 10% Cr were measured at 750 to 1025 C. The nature of the corrosion products was investigated by metallography, X-ray diffraction and chemical analysis. At very low Cr concentrations, there was a small increase in the oxidation rate compared with pure Fe for short times, but for longer times the rate diminished. The oxidation rate at a given temperature diminished with increasing Cr concentration. The rates were not given by any simple rate law, presumably because the products contained many pores and cracks. The accelerations in rate during an isothermal measurement did not occur at reproducible times or average thicknesses, which suggested that scale fracture played an important role. A mechanism for scale embrittlement by Cr was proposed. The ways in which Cr might contribute to a reduced rate of oxidation of Fe were discussed. – D. Lai, et al. *Corrosion*, v. 17, July 1961, p. 109-116.

Physical and Chemical Considerations Concerning the Problem of the **Corrosion Processes** Produced by **Flue Gases** in Steam Boiler Operation – Part of a series of articles in this issue on corrosion associated with **steam boilers.** Other titles include the combating of corrosion and incrustation in steam boilers in the firing of fuel oils rich in S, the formulation of deposits and the contamination of air, and the combating of low temperature corrosion in oil-fired steam boiler plants. (*In German.*) Physikalisch-chemische Betrachtungen zur Frage der rauchgasseitigen Korrosionserscheinungen im Dampfkesselbetrieb. – A. Bukowiecki. *Schweizer Archiv für angewandte Wissenschaft und Technik*, v. 27, May 1961, p. 180-193.

• Effects of the *p*H of the Medium and of the Interface on the Inhibition of Metals – Studies several **corrosion inhibitors** such as chromates, nitrites, phosphates, the salts of certain metals such as Zn and the amines, and the combination of two or several inhibitors. The same substance for the same metal can inhibit or stimulate corrosion according to slight variations in the pH. (*In French.*) Influence du pH du milieu et de l'interface sur l'inhibition des métaux. – J. Frasch. *Corrosion et Anticorrosion*, v. 9, nos. 7-8, July-Aug. 1961, p. 225-234.

• The Prevention of **Silver Tarnishing** – A comprehensive survey of the tarnishing of Ag and its alloys. Methods of testing, improvement by alloying, and protective measures are described. (*In German.*) Der Anlaufschutz des Silbers. – H. C. A. Burkhardt and H. Schlegel. *Metall*, v. 15, July 1961, p. 643-654.

Stress-Corrosion Cracking: A Review of Current Status – An attempt is made to clear up this apparent confusion by classifying the various modes of cracking and by illustrating each with typical examples. Topics discussed include static and cyclic stresses, tensile and compressive stresses, electrochemical mechanisms, molten phase attack, and hydrogen cracking. Probably the most important type of stress-corrosion cracking, from a practical standpoint, is that which is now recognized as being associated with electrochemical phenomena. Many examples have been observed and studied, but only limited progress has been made toward a basic understanding of how the

cracking initiates and progresses. This type of cracking involves a complex interplay of metallurgical and chemical factors, the study of which has taxed the ingenuity of experimenters. Definite progress has been made, however, and recent accomplishments are reviewed. – W. Lee Williams. *Corrosion*, v. 17, July 1961, p. 92-96.

On a **Surface Energy Mechanism** for Stress-Corrosion Cracking – **Stress-corrosion cracking** is proposed as a process in brittle fracture, whereby the surface energy associated with crack formation is reduced by the adsorption of atom or ion species in the stress-corrosion medium. The grain size dependence of stress-corrosion cracking stress in tensile loading has been studied in two-stress-corrosion systems. The dependence has been analyzed in terms of the Petch-Stroh equations for dislocation nucleated cracks to yield the effective surface energies. These have been shown to be of the proper magnitude for brittle fracture. – E. G. Coleman, D. Weinstein, and W. Rostoker. *Acta Metallurgica*, v. 9, May 1961, p. 491-496.

Teflon Liner Repairs Corroded Pipe – **Stress-corrosion failure** of a buried **steam pipe** in a radioactive area was **repaired** by drawing a **Teflon tube** through the cracked pipe. – Kenneth K. Campbell and Paul S. Kingsley. *Chemical Engineering*, v. 68, Aug. 7, 1961, p. 156 + 2 pages.

Low-Pressure, High-Temperature Oxidation of Tungsten – In many proposed applications, such as high-altitude flight and atmospheric re-entry, components are subjected to high temperatures and low pressures in air. Thus, the oxidation behavior of **tungsten** in air at pressures from 1 to 40 mm Hg and temperatures from 1300 to 3000 C was studied; and the results summarized. – R. A. Perkins and D. D. Crooks. *Journal of Metals*, v. 13, July 1961, p. 490-493.

A Method for Prevention of **Hydrogen Embrittlement** of Tantalum in Aqueous Media – Contact of **tantalum** with an extremely small area of Pt appears to be a particularly effective method for preventing H_2 embrittlement. Whereas Ta is embrittled in a few hours in concentrated hydrochloric acid at 190 C (374 F), a system with a Ta to Pt area ratio of 10,000 to 1 is immune to embrittlement for more than 1000 hours. The corrosion rate of Ta is not increased by such contact and, in some cases, actually decreases. In addition, the corrosion rate of Pt is reduced to a negligible value by contact with Ta. – Claude R. Bishop and Milton Stern. *Corrosion*, v. 17, Aug. 1961, p. 85-91.

° Some Noteworthy Advice on the Prevention of **Incrustation** – On the strength of American and British publications, the composition and form of deposition of the incrustation formed by the evaporation of **sea water** are surveyed, and reference is made to an agent, developed by the British Navy, which is designed to prevent such incrustation. In addition, mention is made of some more recent structural suggestions which reduce the quantity of incrustation. (*In German.*) Einige bemerkenswerte Hinweise zur Verhütung von Kesselstein. – Kurt Fischbeck. *Werkstoffe und Korrosion*, v. 12, June 1961, p. 361-364.

° The **Polarization** of **Metals** in Boiling, Distilled **Water** – A survey of the polarization behavior (both cathodic and anodic) of sixteen metals in boiling distilled water is presented. – J. E. Draley, F. E. DeBoer, and C. A. Youngdahl. *Electrochemical Society, Journal*, v. 108, July 1961, p. 622-628.

Corrosion of Metals in **Tropical Environments.** V. **Stainless Steels** – Eight-year exposure tests of six stainless steels to **underwater and atmospheric environments** in Panama Canal Zone are described. Test environments included sea water immersion, lake water immersion, seashore inland, inland, sea water mean tide, and seashore. Structural steels, phosphor bronze and naval brass were also evaluated for comparison. Stainless steel plates later were galvanically coupled to carbon steel strips for testing in tropical waters. Stainless steels were not recommended for sea water service where perforation of structure is a consideration. They gave excellent results, however, in tropical fresh water. Tropical atmospheres appeared more corrosive to stainless steels than did temperature climates. – A. L. Alexander, C. R. Southwell, and B. W. Forgeson. *Corrosion*, v. 17, July 1961, p. 97-104.

METALS—EXTRACTION AND REFINING

a Reduction of **Iron Oxides,** With Special Reference to **Wustite** – Concerns the interplay among solid state diffusion, heterogeneous reaction, and pore diffusion as the elementary processes in the **reduction** of magnetite and hematite. Cites the need for further studies of pore structure of ores and the changes it undergoes during the reduction process. – O. Knacke. *Henry Brutcher Translation No.* 4802, 13 pp. (From *Archiv Eisenhüttenwesen*, v. 30, no. 10, 1959, p. 581-584.) Henry Brutcher, Altadena, Calif.

b ° **Direct Reduction** of Ferric Oxide by Solid Carbon in Vacuum – Verifies that the diffusion of Fe ions within the oxide crystal, rather than the diffusion of C atoms into the iron oxide as held earlier, is the rate-determining process in the reduction of **ferric oxide.** – T. S. Yun. *American Society for Metals, Transactions*, v. 54, no. 2, June 1961, p. 129-142.

c ° **Iron** Production Methods in Current Development – **Rotary-kiln** processes; sponge iron; and **electric smelting.** – W. H. Dennis. *Mining Magazine*, v. 105, no. 1, July 1961, p. 13-18.

d **Special Quality Pig Iron** Production. **New Blast Furnace** Blown-In at Millom – *Metallurgia*, v. 63, June 1961, p. 273-275.

e **Electric Furnace** or **Cupola Basic Oxygen Converter** for the Nonintegrated Steel Plant – The expected rate of operations, desired flexibility, operational cost, quality of raw materials, product range, and the ability to integrate existing facilities are factors to be investigated in the consideration of expansion of steelmaking facilities for either a semi- or **nonintegrated steel plant.** – D. A. Sutch and H. C. Manley. *Iron and Steel Engineer*, v. 38, July 1961, p. 101-107.

f The Automated **Blast Furnace**--Fact or Fiction? – **Computer controls** applied to the blast furnace may permit substantial coke savings and increase production. Economic justification is an individual problem to be solved for each furnace. – J. E. Oram. *Iron and Steel Engineer*, v. 38, July 1961, p. 119-125.

g **Continuous Casting** of Steel – Surveys present day position of semi-continuous and continuous casting of non-ferrous and ferrous metals and alloys, and sets out the metallurgical foundations of continuous casting. A critical survey of the development of present-day methods of continuous casting of **steel,** both abroad and in the Soviet Union, is given and some technical details regarding equipment are considered. The technological parameters of continuous casting of steel are indicated and the results of comparative investigations of the quality of cast ingots produced by continuous casting and by the normal method of casting into ingot molds are given. Economic considerations and the future of continuous casting of steel are also examined. – M. C. Boichenko. 218 pp. 1961. Butterworth Inc., Washington 14, D. C. (TS230 B63ntr)

h On the Refining of **Basic Bessemer Irons** by **Oxygen Top Blowing** [LD Process]. II – Development of a new refining practice in a three-ton pilot converter and application of results, to trial operations in a 60-ton converter, making use of new theoretical data obtained earlier, and the principle of similarity. – W. Plöckinger, et al. *Henry Brutcher Translation No.* 5000, 16 pp. (From *Stahl und Eisen*, v. 80, no. 22, 1960, p. 1481-1486.) Henry Brutcher, Altadena, Calif.

i A **Thermochemical Model** of the Blast Furnace – A method of calculating the changes in **blast-furnace** performance brought about by burden and/or blast modifications is presented. Essentially the method consists of three simultaneous equations derived from materials and heat balances. These equations can be used not only to evaluate quantitatively the effect of changes in process operating variables on furnace performance, but also to provide a useful means of evaluating changes in process variables which cannot be measured directly. – H. N. Lander, H. W. Meyer, and F. D. Delve. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 485-492.

j ° Selecting the **Optimal Inoculator Composition** of Boron-Antimony for **Malleable Cast Iron** – Investigations revealed that the modifying mixture of 0.005% and 0.003% Sb can be used for the neutralization of the harmful effect of Cr on graphitization

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and, with a 0.08-0.10% Cr content, for the decrease of the continuity of the malleabilizing process. Increasing the Sb content in the mixture up to 0.005-0.07% produces a high strength perlitic cast iron with $\delta = 2$–5%. (*In Russian.*) Podbor optimal'nogo sostava modifikatora bor-sur'ma dlia kovkogo chuguna. – E. G. Titenskiĭ. *Liteĭnoe Proizvodstvo,* 1961, no. 5, May, p. 7-8.

The **Electrochemical Theory** of **Smelting** and Related Reactions – Concerns the potentials and electrical currents flowing at an interface between two phases as a result of chemical reactions which promote selective ion migration. Although our immediate concern is an explanation of the available results on smelting, a sufficiently broad understanding requires that we go far beyond these limited results and bring together the findings from many related fields: multibarrier diffusion–diffusion of electrified molecules; diffusion of charged particles in an electric field; membranes as rectifiers; and diffusion coupled with reaction. – Xavier de Hemptinne, Henry Eyring, and Taikyue Ree. Paper from "Physical Chemistry of Process Metallurgy. I.", v. VII, p. 65-93, 1961, Interscience Publishers, New York. (TN1 P56)

METALS—FINISHING, POLISHING AND CLEANING

Chemical Cleaning of Metal Parts – Lester F. Spencer. *Machine Design,* v. 33, July 20, 1961, p. 134-141.

• Varied **Finishes** From a Single **Abrasive Dry Honer** – *Western Metalworking,* v. 19, July 1961, p. 25-26.

• Effect of **Surface Finish** on Properties of **Beryllium Sheet** – As received, surface-ground, milled, shot-peened, and etched surfaces were evaluated by tension tests (at room, subzero, and elevated temperatures), notched tensile tests, fatigue tests, and impact tests. – W. V. Ward, M. I. Jacobson, and C. O. Matthews. *American Society for Metals, Transactions,* v. 54, no. 1, Mar. 1961, p. 84-95.

Cleaning and **Finishing** Operations on **Electrical Equipment** – Includes coatings data. – W. L. Huss. *Industrial Finishing,* v. 37, no. 9, July 1961, p. 40-43.

• This **Barrel** Spins and Vibrates – **Vibration** as a fast, efficient tool for finishing metals. Combined with a rotary motion it produces a "waterfall" effect, claimed to reduce deburring and polishing time, save on compounds, and cut direct labor costs. – A. A. Polucha. *Metalworking Production,* v. 105, no. 27, July 5, 1961, p. 83.

Mechanical **Finishes** – A design guide to specifying surface finishes: types of finishes, finishing methods, and factors that influence choice of finish. – Lester F. Spencer. *Machine Design,* v. 33, Aug. 17, 1961, p. 164-172.

• Discover **Vibratory Finishing** – Heavy scale, burrs, or flash can quickly be removed. Radii can be formed to exact blueprint specifications. Surface roughness can be reduced to obtain low micro-inch finishes. In addition, parts may be cleaned, colored, or burnished. – William E. Brandt. *Machinery, (New York),* v. 67, no. 12, Aug. 1961, p. 81-89.

• The **Radiotracer Testing** Method in **Metal Cleaning** Studies – The contamination of metallic surfaces with sulfates, chromates, and fatty acids was investigated. The detection sensitivities for $S^{35}O_4^=$, Cr^{51}, palmatic and stearic-1-C^{14} acids were determined. Results show that electropolished Cu surfaces retained less than 3×10^{-8} g $SO_4^=$ and less than 1.5×10^{-7} g of C. Toluene and chromic acid were found to be excellent cleaning agents for fatty acids. – G. D. Fatzer, J. M. Schroeer, and B. E. Blake. *International Journal of Applied Radiation and Isotopes,* v. 10, no. 4, July 1961, p. 167-176 + 1 plate.

• Mechanized **Metal-Finishing** Operations – Some examples of methods used. – S. C. Poulsen. *Machinery (London),* v. 98, June 28, 1961, p. 1452-1460.

How to Exploit New Technology in **Surface Preparation** – To find out what techniques will help reduce finishing costs and improve end products, a number of experts in surface preparation were queried. – *Steel,* v. 149, July 10, 1961, p. 70-73.

Functional **Finishes** for Metals – Comparison of properties and costs. – Herbert L. Kee. *Product Engineering,* v. 32, no. 29, July 17, 1961, p. 39-50.

a • Research Techniques of the Non-Ferrous Metal Semiproduct Industry. VI. Recent Cleaning Methods in the Non-Ferrous Metal Industry – A brief survey of some of the common modern **descaling** equipment for **non-ferrous metals.** (*In German.*) Verfahrenstechnik der Nichteisenmetall-Halbzeugindustrie. VI. Neuere Beizverfahren in der Nichteisenmetall-Industrie. – Peter Petri. *Zeitschrift für Metallkunde,* v. 52, June 1961, p. 437-439.

b •

METALS—FOUNDRY PRACTICE

c • **Desulphurizing Carbon Steel** to Extra-Low Limits. – It is possible to reduce S levels below 0.005% without substantial increase in cost over the standard two-slag process. – A. J. Kiesler. *Modern Castings,* v. 40, July 1961, p. 46-47.

• • **Sampling** of **Sand** – A survey of sampling techniques and the probable error that can be expected in **sieve tests.** Survey showed that there is no universal, simple method of sampling. Each laboratory, foundry or mining operation has its own special technique or method which is satisfactory for its own conditions but not satisfactory for everyone. Nometallics will segregate according to grain distribution, density, moisture content and method of loading. The most uniform sample can be taken while the material is being loaded for shipment. – *Modern Castings,* v. 40, July 1961, p. 49-54.

d •

e • Core Production in Hot Core Boxes – A French technique using **thermosetting binders** and **hot core boxes** produces precision castings at lower costs. Varying proportions of sugar and urea formaldehyde are used as binders in the process. Different techniques to those at present being developed in the U.S. – Philippe Jasson. *Modern Castings,* v. 40, July 1961, p. 55-64.

• • **Ductile Iron** Graphite Form Classification – **Graphite type and size** charts are presented for the rating of structures of ductile irons. Charts are needed to classify graphite forms of spherulitic shape, and modifications between flake and spherulitic graphite. Matrix structure is estimated by examination of etched specimens under magnification and estimating percentages of carbides, pearlite and ferrite. These charts are offered as an interim suggestion until standards have been established for these graphite shapes and sizes. – C. K. Donoho. *Modern Castings,* v. 40, July 1961, p. 65-71.

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• • Calcined Fluid Coke as New **Molding Medium** – Produced by a new petroleum refining process. Describes a preliminary investigation of the use of **calcined fluid coke** as a new molding medium, replacing sand in green and baked molds, baked cores and shell molds, and as the principal ingredient of a mold and core wash. Its inert nature and low thermal expansion are principal properties credited for advantages shown over sand. – E. G. Gentry and C. L. Lear. *Modern Castings,* v. 40, July 1961, p. 88-95.

h •

• • **Bronze** Valve Vertical **Gating in Shell Molds** – Casting 85-5-5-5 and *M* metal pressure containing parts. The efficiency of the system has been demonstrated in shop use by a rejection rate less than 3%. – F. E. Murphy, G. J. Jackson, and R. A. Rosenberg. *Modern Castings,* v. 40, July 1961, p. 81-87.

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• • **Calcium Carbide** Use in **Acid Cupolas** – Has found wide use in West German iron foundries as a cupola addition to raise the temperature of the Fe, increase melting rates and permit a reduction in the amount of coke used in the melting process. Lowered coke consumption results in a reduction in the S content of the iron. Gives examples of the use of the special carbide. – R. Schulze. *Modern Castings,* v. 40, July 1961, p. 75-80.

j •

• • **Plastic Patternmaking:** the **Polyurethane** Concept – Outlines and describes methods whereby highly resilient plastics and metals help provide ideal abrasion resistant characteristics and low cost hitherto deemed impossible in processing of foundry pattern equipment. – Henry A. Burton. *Modern Castings,* v. 40, July 1961, p. 72-74.

k •

METALS—HEAT TREATMENT

Recent **Heat Treatment Furnace** Installations – Survey of developments. – *Metallurgia*, v. 63, June 1961, p. 283-304.

Dual Atmospheres Team Up to Cut **Heat Treat Costs** – *Iron Age*, v. 188, no. 2, July 13, 1961, p. 92-93.

Case Hardening of Automotive **Gears** – Describes introduction of NH_3 into vertical, continuous gas carburizing furnaces to saturate the diffusion layers with N as well as utilize these furnaces for heating parts for hardening in highly active gaseous surroundings. – B. A. Stetsenko. *Henry Brutcher Translation No.* 4958, 4 pp. (From *Metallovedenie i Term. Obrabotka Metallov*, Aug. 1959, p. 45-48.) Henry Brutcher, Altadena, Calif.

Phase Changes in **Carbon Steels** During Accelerated Heating – Studied phase changes in carbon steels during **accelerated heating** using equipment which records simultaneously dilatometric and magnetometric heating curves, on steel U8A (0.83% C, pearlite) and U10 (0.99% C, spheroidite). – G. T. Fomin. *Henry Brutcher Translation No.* 4962, 2 pp. (From *Metallovedenie i Term. Obrabotka Metallov*, Aug. 1959, p. 54-55.) Henry Brutcher, Altadena, Calif.

How Oliver Heat Treats **Gears** – **Induction hardening** is used to produce the required physical properties in the teeth. – Kenneth Rose. *Automotive Industries*, v. 125, no. 1, July 1, 1961, p. 43 + 1 page.

Metal **Stampings** Gain Toughness From Automatic **Austempering** – Ray Howland. *Iron Age*, v. 187, no. 27, July 6, 1961, p. 72-73.

METALS—MECHANICAL AND PHYSICAL PROPERTIES

Tungsten-Columbium-Tantalum Alloys, Their High-Temperature Properties – Alloy compositions blanketing the W-Cb-Ta ternary system were screened by means of hardness tests at 2300 to 2900 F and weight gain in O at 2190 F. These tests delineated areas combining high **hot-hardness** with at least tenfold improvement in **oxidation resistance** over that of pure metals. – J. L. Wilson and C. R. McKinsey. *Journal of Metals*, v. 13, July 1961, p. 494-496.

Review of Recent Developments in the Evaluation of Special Metal Properties – Reviews current developments in techniques for **special testing** of materials, results of these tests, and sources of information on special testing procedures. – J. E. Campbell. *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 112, June 27, 1961, 10 pp. (TN799 B32.2d Contin.)

The Emittance of **Stainless Steels** – Compiles original test data on **emittance,** reflectance, and absorptance as reported in the literature published during the period 1940-1959 inclusive, and as much of the 1960 literature as could be obtained. – W. D. Wood, H. W. Deem, and C. F. Lucks. *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 111, June 12, 1961, 67 pp. (TN799 B32.2d Contin.)

° Change in the **Electric Resistance** of Certain Metals Up to 250,000 kg/cm² – The object of this work is the search for new polymorphic transformations in metals accompanied by a staggered change of electric resistance at **very high pressures.** Electric resistance changes are described for Re, Nb, and Y. The electric resistance of Wood's alloy was also measured. (*In Russian.*) Izmenenie elektricheskogo scprotvleniia nekotorykh metallov do davleniia 250,000 kg/cm². – L. F. Vereshchagin, A. A. Semerchan, N. N. Kuzin, and S. V. Popova. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 1, May-June 1961, p. 84-85.

° **High-Speed Steels** With Lower Carbide Inhomogeneity – For high-speed steels with not over 1.7-1.9% V and satisfactory grindability, two W concentrations are characteristic: with 7-8% W, there is high-red hardness, secondary hardness and **lower carbide inhomogeneity,** but the steel keeps its sensitiveness to overheating; with 12-13% W, a fine grain is maintained, but the steel has a somewhat higher carbide inhomogeneity than a steel with 7-8% W. (*In Russian.*) Bystrorezhushchie stali s ponizhennoĭ karbidnoĭ neodnorodnost'iu. – Iu. A. Geller, L. S. Kremnev, and Ts. L. Olesova. *Metallovedenie i Obrabotka Metallov*, 1961, no. 6, June, p. 25 + 6 pages.

° Physical Properties of **High Purity Metals** – Studies the electric resistance, the reflecting capacity, the permeability, the nuclear reaction, the effects of radioactive radiation, the intercrystallite boundaries, the latent energy of plastic deformation, the internal friction and elasticity moduli and the mechanical properties of such metals as Al, Ba, Bi, Ga, Mg, Cu, Sn, Cr, Zn and others. (*In Russian.*) Fizicheskie svoistva metallov povyshennoi chistoty. – R. I. Garber and I. A. Gindin. *Uspekhi Fizicheskikh Nauk*, v. 74, no. 1, May 1961, p. 31-60.

Delay Time in Single Crystals of **Aluminum,** Zinc, and Iron – Measured under conditions of **high-speed deformation.** The delay time of aluminum was found to be affected by the orientation of the crystal. Under the dynamic conditions employed, the calculated "activated volume" term appears to be very small for the three metals studied. The delay time for single crystals of **iron** was smaller than that reported for low-carbon steels of higher impurity content. **Zinc** single crystals saturated with nitrogen also had delay-time values higher than those obtained from zinc crystals grown in vacuum. – I. R. Kramer. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 474-478.

Effect of Copper Additions on the Activation Energies for Creep of **Aluminum Single Crystals** – Determined over the range from 78 to 850 K. Below 240 and above 800 K activation energies were unchanged. Between 240 and 400 K strain aging causes the **creep** rate to become vanishingly small and the flow stress was independent of the temperature. Between 500 and 50 K the activation energy was increased to 41,000 cal per mole. – D. Walton, L. Shepard, and J. E. Dorn. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 458-460.

Notch Sensitivity of **Refractory Metals** – The tensile and notch tensile properties of four refractory metals (Mo, W, Nb, and Ta) and one alloy (Mo-0.5Ti) were investigated. All the materials were evaluated in bar form, and the Mo and Mo-0.5Ti also were studied in sheet form. The **notch sensitivity** of each material was evaluated on the basis of several criteria, including the notch-unnotch strength ratio, the ductility transition, and the fracture transitions. – A. G. Imgram, F. C. Holden, H. R. Ogden, and R. I. Jaffee. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 517-527.

Development of **Copper Base High Strength-Medium Conductivity Alloys** Cu-Ti-Sn and Cu-Ti-Sn-Cr – Two new precipitation hardening copper-base alloys, Cu-1.5% Ti-2.5% Sn and Cu-1.5% Ti-2.5% Sn-0.4% Cr were developed. High strength and medium conductivity are obtained by solution annealing and subsequent heat treatment. Combination of solution annealing, cold working, and heat treatment increases the strength further. Good elevated temperature strength and ductility makes these alloys superior to copper-beryllium-cobalt alloys. – Matti J. Saarivirta. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 596-606.

The Melting of Malleable **Nickel and Nickel Alloys** – The effects of minor constituents on the **malleability** of nickel alloys are described. These effects are related to the atomic diameter, valence, and position on the Periodic Table. The basic methods for removal or neutralization of deleterious elements are then reviewed. Finally, practical methods for melting nickel alloys are described in detail and related to minor constituent control. – C. G. Bieber and R. F. Decker. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 629-636.

Device for the Rapid Measurement of **Magnetic Anisotropy** at Elevated Temperatures – The instrument consists of a self-exciting torsion pendulum containing the magnetic sample, which is suspended in a magnetic field in a furnace. The

resonance frequency of the pendulum, which depends on the anisotropy energy in a known way, lies between 10 and 100 cps so that the time required for a measurement is shorter than in other methods. The instrument is therefore capable of following a rapidly changing anisotropy, e.g., during the magnetic annealing of the sample. The measurement of the anisotropy of a single crystal of Ticonal G magnet steel during cooling from 900 to 400 C in a magnetic field is described as an example. – H. Zijlstra. *Review of Scientific Instruments*, v. 32, June 1961, p. 634-638.

Tensile Testing Machine for **Whiskers** – A synchronous motor moves one of the grips at a constant velocity, whereas the second grip is connected to a load cell in which a differential transformer is employed. – H. B. M. Wolters and F. W. Schipink. *Journal of Scientific Instruments*, v. 38, June 1961, p. 250-252.

Micro-Tensile Testing Machine – For microscopic specimens. It can apply loads in the range from 1 mgf to 400 gf to specimens having cross-sectional areas down to 10^{-7} mm^2. Specimen extensions from a few angström units to 15 mm can be measured and, at constant temperature, random errors in the extension measurement system are less than 5 Å (5×10^{-7} mm). The machine employs a torsion balance to apply the loads and a mirror-autocollimating telescope system to detect the extensions. Since it depends wholly on mechanical and optical principles it is practically drift-free at constant temperature. It is adaptable for tests in special atmospheres, for autographic recording and for tensile testing of thin films. – D. M. Marsh. *Journal of Scientific Instruments*, v. 38, June 1961, p. 229-234.

• Contribution to Short-Time Creep Strength of **Platinum Alloys** Between Room Temperature and 1250° C. II – The time creep strength of Pt and its alloys with 4% Pd or Ru, with 5% Au, Ir or Rh as well as with 10% Ir or Rh were investigated up to 100 hr, between 20 and 1100 C, and partly up to 1250 C. At 1100 C the creep strength of the materials mentioned is about σ B/100 = 0.5(Pt, Pt/4% Pd) up to 1.2 kp/mm^2 (Pt/10% Rh). The quotient σ B/100 h : σ B, characterizing the time dependency of the **creep strength** changes from 0.9 at 20 C with increasing test temperature up to values between 0.28 and 0.13 at 1250 C. (*In German.*) Beitrag zur Kurzzeitstandfestigkeit von Platin-Werkstoffen zwischen Raumtemperatur und 1250°C. II. – G. Reinacher. *Metall*, v. 15, July 1961, p. 657-665.

Statistical Analysis of **Tensile Properties** of Heat-Treated **Ti-4Al-3Mo-1V** and Ti-2.5Al-16V Sheet – Tensile properties (ultimate strength, yield strength, and elongation) are examined statistically. When solution treated and aged, Ti-4Al-3Mo-1V has a higher ultimate strength than does **Ti-2.5Al-16V,** but the two alloys are about even in yield strength and elongation. When solution treated, Ti-2.5Al-16V is unquestionably the stronger. These conclusions are independent of producer. There is not much difference in the same alloy produced by different companies. – G. H. Beatty and H. R. Ogden. *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 46J, June 6, 1961, 32 pp. (TN799.T5 B32.7t Vis.)

METALS—MECHANICAL WORKING

Cold Forging Blasts Barriers – Integrated lines speed chipless production of auto parts. – R. H. Eshelman. *Iron Age*, v. 187, no. 27, July 6, 1961, p. 69-71.

• **Radioactive Isotope Investigation** of **Die Wear** as a Function of Lubrication and Drawing Rate – Increasing the drawing rate up to 2.5 m/sec for **wires of carbon steels** is fully justified from an economic and technical point of view. Changes in the rate of drawing do not cause any sharp increase of wear of the dies. With steels with lower C contents, a lime lubricating coating or soap powder should be used, except in the case where a P coating is more economical due to elimination of thermal treatment. In the case of steels with higher C content, a P coating must be used to obtain less wear of the die than with a lime coating. (*In Polish.*) Badanie za pomocą izotopów promieniotwórczych zużwania się ciagadeł w zależności od smarowania i szybkości ciągnienia. – Jan Kieszniewski, Lesław Kuś, Jerzy Siewierski, and Roman Wusatowski. *Hutnik*, v. 28, no. 3, Mar. 1961, p. 91-106.

Forging Unclad **Beryllium** – Demonstrates that hot-pressed Be metal may be **bare forged** successfully into certain configurations. Details of the required procedures are presented. – J. P. Denny and J. D. McKeogh. *Journal of Metals*, v. 13, June 1961, p. 432-433.

Grinding Fluids. II. How They Affect Grinding Action – Influences of fluids on **grinding action** depend on the nature of the work material. Quantitative data are presented for **steels, high-temperature alloys,** and **titanium alloys.** – L. P. Tarasov. *Tool and Manufacturing Engineer*, v. 47, no. 1, July 1961, p. 60-67.

• The Mold Forming of Parts From Molten Steel – The specific pressure necessary to obtain quality parts by **pressing molten carbon steel** depends on the configuration of the part; with a wall thickness ratio of 1:1, it is 4 to 6 kg.mm^2. The presence of a hot center requires a maximum specific pressure of the order of 20 kg/mm^2, which is used for the deformation of hardened metal layers. The pressing time depends on the highest thickness of a section of the part; for steel it is about 0.5 sec for a 1-mm thickness. (*In Russian.*) Pressovanie detaleĭ iz zhidkoĭ stali. – V. P. Severdenko and T. P. Maleĭ. *Akademiia Navuk Belaruskaia SSR, Doklady*, v. 5, no. 6, June 1961, p. 253-255.

• **Cutting Fluid** Performance – Quantities of major importance in use of a cutting fluid are surface finish and tool life. Three **screening tests** of value are the four ball wear test, a tapping test, and a low speed orthogonal cutting test. – I-M. Feng, A. Gujral, and M. G. Shaw. *Lubrication Engineering*, v. 17, July 1961, p. 324-329.

• Automation of a Speed Measuring System for **Hot Rolled Strip** by the Correlation Method – The author considers an optimalizing system for automation of the **speed measurement** process for hot rolled strips using **correlation techniques.** Two variable time-delay circuits are presented, one employing valves, the other based on reactors with magnetization. It is shown that a differential circuit (based on subtraction) may be used as well as a correlation circuit (based on multiplication.) It is also possible to design an adaptive system with a second optimalizing control loop using the second harmonic of the modulating signal. (*In Ukranian.*) Avtomatyzatsiia systemy vymiriuvannia shvydkosti horiachoho prokatu korreliatsiĭnym metodom. – S. F. Kozubovs'kii. *Avtomatyka*, 1961, no. 3, p. 64-73.

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

Carbide Phase in **High-Silicon Cast Iron** – A study of synthetic cast iron with 1.5% C, 5.8% Si and very low Mn and P for nature of **carbide phases** present in it. – Ya N. Malinochka and G. Z. Koval'chuk. *Henry Brutcher Translation No.* 5123, 6 pp. (From *Dopovidi Akad. Nauk Ukrainsk. RSR*, 1961, no. 1, p. 25-28.) Henry Brutcher, Altadena, Calif.

• Effect of **Cobalt** on the Coefficient of Diffusion of **Carbon** and Nitrogen in **Ferrite** – This influence was studied by means of the internal friction from the room temperature up to 200 C approximately. This influence is low and acts, as a rule, in the sense of a decrease of the coefficient of **diffusion.** In the case of nitrogen, however, above 70 C there is an anomaly in the variation of the coefficient of diffusion as a function of the Co content. This variation tends toward an increase of the coefficient for a 2% Co content and toward a decrease for a 10% Co content. (*In French.*) Influence du cobalt sur le coefficient de diffusion du carbone et de l'azote dans la ferrite. – J. Delatte. *Métaux Corrosion-Industries*, v. 36, Apr. 1961, p. 161-168.

Quantity of Oxide Inclusions in Killed [Low-Carbon] Steel as Function of Way Aluminum Is Introduced for **Deoxidation** – A production-scale study of 0.16% plain carbon **steel** from 200-ton basic open-hearth furnace for effect of various deoxidizing practices using **aluminum,** upon oxygen content. Lists

effect of various aluminum additions in ladle and mold on oxygen content, total nonmetallic inclusion content, inherent grain size and room-temperature impact strength of steel. – S. F. Karp. *Henry Brutcher Translation No.* 4927, 12 pp. (From *Izvest. VUZ-Chern. Met.*, July 1960, no. 7, p. 49-53.) Henry Brutcher, Altadena, Calif.

Transformation Kinetics in **High-Purity Iron** and Some **Iron Binary Alloys** – The characteristics of the motion of the γ - α interface during the "down" transformation was studied in zone-refined iron and dilute binary alloys containing Ni and Mo by means of the thermionic emission microscope and high-speed photography. The frontal movements were found in all cases to be definitely discontinuous with time and an appreciable number of incremental jumps were found to proceed in the reverse direction (α to γ). Molybdenum was found to be particularly effective in increasing the frequency of the increments of transformation from the stable to the metastable phase. – V. Bharucha, G. A. Mancini, G. W. Powell, and J. W. Spretnak. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 498-503.

• Polymorphic **Chromium Transformations** and Phase Diagram for the **Chromium-Tungsten System** in the Region Rich in Chromium – (*In Russian.*) Polimorfnye prevrashcheniia khroma i diagramma sostoianiia krom-vol'fram v oblasti, bogatoi khromom. – A. T. Grigor'ev, E. M. Sokolovskaia, A. P. Nefedov, and M. V. Maksimova. *Moscow, Universitet, Vestnik, Seriia II, Khimiia*, v. 16, no. 2, Mar.-Apr. 1961, p. 19-24.

Penetration of Liquid Bismuth Into the Grain Boundaries of a **Nickel Alloy** – Columnar grained specimens of Ni, containing 0.25% Si and 0.22% Mn, have been exposed to **liquid bismuth** in the temperature range 670 to 1050 C. Under isothermal conditions the liquid penetration rate is constant. The activation energy for the process is 22,000 cal per g-atom. Small amounts of plastic deformation, introduced into specimens prior to exposure, increase the penetration rate. The slow step in liquid film penetration is associated with a reaction which occurs at or near the leading edge of the film. Either transfer of Ni across the liquid-solid interface or diffusion in the **grain boundary** ahead of the liquid film is suggested. – R. F. Cheney, F. G. Hochgraf, and C. W. Spencer. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 492-498.

Phase Diagram and **Thermodynamic Properties** of the Thorium-Zinc System – Thermal, metallographic, and vapor pressure data were obtained to establish the phase diagram for the **thorium-zinc system**. Four compounds corresponding to the stoichiometric formulas Th_2Zn, $ThZn_2$, $ThZn_4$, and Th_2Zn_{17} were observed. Four eutectics exist in this system. The standard free energy, enthalpy, and entropy of formation for the compounds were determined from zinc vapor pressure data. – P. Chiotti and K. J. Gill. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 573-580.

The **Liquid State** and the **Liquid-Solid Transition** – Defines fluid and solid. Investigates glass transition, thermodynamics of crystallization, theory of liquids, and models of liquids; diffusion, the liquid solid transition, and the liquid glass transition. – David Turnbull. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 422-438.

Secondary Recrystallization Kinetics in Singly Oriented Silicon Iron – When commercial **silicon iron** sheets of varying magnetic quality are isothermally annealed at high temperatures, extremely large grains develop in the material having good magnetic properties. These grains are of the (110)[001] orientation and are formed by secondary recrystallization. The primary driving force for this secondary recrystallization is grain boundary free energy. For the secondary grains, activation energies of 103 kcal per mole for nucleation, and of 75.5 kcal per mole for growth, were obtained. The activation energy for nucleation of the secondary grains is consistent with a model involving redistribution of a precipitate acting as the primary grain-growth inhibitor. – T. V. Philip and R. E. Lenhart. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 439-445.

The **Zirconium-Platinum Alloy System** – Investigations of the Zr-Pt system, by metallography, incipient melting, and X-ray diffraction, determined the phase relationships from 0 to 50 at.% Pt. Phase fields in the Pt-rich region were outlined, and three intermetallics ($ZrPt$, Zr_2Pt, and $ZrPt_3$) were located. A eutectic between βZr and Zr_2Pt, and a eutectoid reaction between βZr and $\alpha Zr + Zr_2Pt$, were established. The maximum solubility of Pt in βZr was approximately 13.5 wt.% as opposed to less than 1 wt.% solubility in αZr. – E. G. Kendall, C. Hays, and R. E. Swift. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 445-452.

Sulfur Equilibria Between Gases and Calcium Ferrite Melts – **Calcium ferrite melts** were equilibrated with sulfur and **oxygen-bearing gases** at temperatures within the range 1290 to 1620 C. The results show that at oxygen partial pressures below 10^{-4} atm., the sulfide-reaction occurs and at higher oxygen pressures the sulfur dissolves in the melt principally as sulfate ion. It is also observed that when the product $p_{SO_2}(p_{O_2})^{1/2}$ increases, sulfate ions are converted to pyrosulfate ions and the results permit the evaluation of the pyrosulfate/sulfate ratio. It is shown that the ratio $\gamma CaSO_4/\gamma CaO$ increases with decreasing concentration of calcium oxide in calcium ferrite, silicate and aluminate melts. Indications are that oxy-acids, e.g., silica, alumina and ferric oxide, increase $\gamma CaSO_4$. A few experiments were carried out within the sulfide range and the results are in accord with those obtained by other investigators on aluminate and silicate melts. – E. T. Turkdogan and L. S. Darken. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 464-474.

Thermodynamic Activities in the **Fe-Mn-C System** – The vapor pressures of Mn in equilibrium with several alloys in the iron-manganese-carbon system between 1200 and 1275 K have been measured using the Knudsen effusion technique in conjunction with a vacuum microbalance. The effect of orifice area of the effusion cell upon the measured pressure has been determined. The binary iron-manganese system shows small negative departures from ideality, and the system of mixed carbides, $(Fe,Mn)_7C_3$, in equilibrium with graphite behaves ideally. – J. F. Butler, C. L. McCabe, and H. W. Paxton. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 479-484.

Binary and Ternary Phase Diagrams of **Columbium, Molybdenum, Tantalum, and Tungsten** – Contains a compilation and discussion of 93 binary and 68 ternary **phase diagrams** of the four refractory metals, Cb, Mo, Ta, and W. Included with each diagram is a discussion which lists information on the solubility and crystal structure of intermediate phases. – J. J. English. *Battelle Memorial Institute. Defense Metals Information Center, DMIC Report No.* 152, Apr. 28, 1961, 226 pp. (TN799.T5 B32.7t Vis.)

• The Appearance of Dislocations on the **Electric Erosion of Single Crystals** – Distribution of **dislocations** produced by spark discharge and etching method on the single crystals of **Bi, Sb,** and **Zn** was studied. (*In Russian.*) O vozniknovenii dislokatsii pri elektricheskoi erozii monokristallov. – L. S. Palatnik, A. A. Levchenko, and V. M. Kosevich. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 1, May-June 1961, p. 96-99.

• Investigation of the Phase Equilibrium in the **Quasiternary System of Ti-Ti_5Sn-Zr** – At low temperatures (lower than the temperature minimum of the Ti-Zr system) the **phase equilibrium** in this system is described by an equilibrium diagram with an uninterrupted series of solid solutions. At higher temperatures the phase equilibrium is described by a spatial complex characterizing a ternary equilibrium diagram consisting of three doubles, of which (β-Ti)-Ti_5Sn and Ti_5Sn-(β-Zr) are diagrams of an eutectic type with restricted solubility in the solid state, and one (β-Ti)-(β-Zr) equilibrium diagram with an uninterrupted series of solid solutions. (*In Russian.*) Issledovanie fazovogo ravnovesiia v kvazitroinoi sisteme Ti-Ti_5Sn-Zr. – V. V. Glazova and N. N. Kurnakov. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 4, June 1961, p. 835-838.

• General Regularities in the Stabilization of Solid β-Solution in **Titanium Alloys** – On the basis of theoretical considerations

and his previous work, the author postulates that the **β-phase** can be obtained in a metastable state in titanium alloys at a practically identical electron concentration equal on the average to 4.2 electrons. (*In Russian.*) Obshchie zakonomernosti stabilizatsii beta-tverdogo rastvora v splavakh titana. – N. V. Ageev and L. A. Petrova. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 2, May 1961, p. 359-360.

• The Peculiar Features of the **Thermodynamics** of **Interstitial Solid Solutions** With the **Body-Centered Cubic Lattice** – (*In Russian.*) Osobennosti termodinamiki tverdykh rastvorov vnedreniia s ob'emnotsentrirovanoi kubicheskoi reshetkoi. – N. S. Fastov. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 2, May 1961, p. 344-347.

• An Investigation of the Growth Kinetics of Grains in **α-Iron** of High Purity – Study of the growth kinetics with rapid heating was undertaken. Experimental data on the **grain growth** at isothermal conditions are well described by Feltham's equation. (*In Russian.*) Issledovanie kinetiki rosta zeren v α-zheleze vysokoi ctepeni chistoty. – V. I. Ivanov and K. A. Osipov. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 2, May 1961, p. 338-341.

Our new format should help you scan the page quickly. Boldface clue words identify subject matter. Titles appear unchanged at the beginning of each abstract.

Synthetic Inclusions in the **FeO-MnO-MnS-SiO_2 System** in Equilibrium With **Resulfurized Steel** – Mixtures of MnS, $2FeO \cdot SiO_2$, $2MnO \cdot SiO_2$, FeO, and MnO were prepared synthetically and used to study the planes $2FeO \cdot SiO_2$-$2MnO \cdot SiO_2$-MnS, FeO-MnO-MnS, and FeO-MnO-SiO_2-MnS in the quaternary system. Because the oxides and silicates studied flux MnS, inclusions in this system are partly liquid during rolling. Also, oxygen can modify subsurface inclusions through the reaction $MnS + FeO \rightarrow FeS + MnO$ during the soaking of ingots and the reheating of blooms and billets. – E. N. Silverman. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 512-517.

Some **Thermodynamic Properties** of the **Cadmium-Copper System** – The partial molal free energy of Cd in each of the four intermediate phases, Cd_3Cu, Cd_5Cu_5, Cd_3Cu_4, and $CdCu_2$ is determined using the Knudsen vapor pressure technique. Measurements are made also within the two-phase regions, and thus the variation in $\Delta\bar{F}_{Cd}$ is now known across the entire phase diagram. It would appear that the lattice parameters previously reported for $CdCu_2$ are in error. – Richard Borg. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 3, June 1961, p. 527-531.

METALS—POWDER

Beryllium Processing by Powder Metallurgy – Describes the powder metallurgical processing of Be into fine-grained forms from which finished shapes are made. Emphasis is given to the **vacuum-hot-press-machine process** which is used for the majority of Be parts being made today. – K. G. Wikle and V. C. Potter. *Journal of Metals*, v. 13, Aug. 1961, p. 537-544.

• The Physical Properties of **Titanium Nitride** in the Homogeneity Region – **Microhardness and electroresistance** of the alloys of titanium with nitrogen in the region of the homogeneity of the phase TiN were studied. It was shown that the lowering of N content in TiN, within the limits of its homogeneity, leads to the fractional increase in **ionic bonding.** (*In Russian.*) Fizicheskie svoistva nitrida titana v oblasti gomogennosti. – G. V. Samsonov and T. S. Verkhogliadova. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 2, May 1961, p. 342-343.

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

a • Radiographic Examination of **Reactor Pressure Vessels** – U.K. Atomic Energy Authority has just taken delivery of a mobile 4.3 million volt linear accelerator designed to make **X-ray examinations** of the pressure vessels of nuclear power stations during construction. – *Metal Treatment and Drop Forging*, v. 28, June 1961, p. 220.

b • Can **Automatic Test Systems** Fill **Reliability** Gaps? – W. N. Redstreake. *Iron Age*, v. 188, no. 2, July 13, 1961, p. 94-96.

c • **Measuring Millionths** – From the ultraprecision of the length of a light wave, to the slightly less precise electromechanical comparison of master gage blocks and test blocks, the standards hierarchy descends until it reaches the inspection-quality gage block used in countless industrial processes. – *Mechanical Engineering*, v. 83, Aug. 1961, p. 40-42.

d • Factors to Consider in Selecting **Ultrasonic Testing Equipment** – Ruggedness, degree of accuracy needed, ambient illumination conditions, instrument stability, dependability, simplicity of operation, size, weight, and portability are all important factors to consider. – R. A. Seidel. *Metal Progress*, v. 80, no. 2, Aug. 1961, p. 83-87.

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

e • Fundamental Particles – A discussion of the **fundamental particles** of matter. Particles such as neutrons, protons, electrons, mesons, positrons, etc. are discussed in a historical manner. – O. R. Frisch. *Institution of Electrical Engineers, Journal*, v. 7, no. 78, June 1961, p. 357-359.

f • Safety and Serviceability in **Reactor Safety Circuits.** II – Theory discussed in Part I is now extended first to a single group of channels and then to whole safety system, and the parameters on which serviceability and safety depends are investigated. – U. Broccardo. *Nuclear Power*, v. 6, July 1961, p. 81-85.

g • Burnout in **Liquid Cooled Reactors.** II – Theoretical analysis compared with experiments; hydrodynamic and heat transfer conditions in a vertical liquid cooled channel; and heat transfer when **burnout** heat flux has been exceeded is considered. – J. G. Collier. *Nuclear Power*, v. 6, July 1961, p. 64-67.

h • Particle States of a Quantized **Meson Field** – A simple nonlinear field theory is considered as the model for a recently proposed classical field theory of mesons and their particle sources. Quantization may be made according to canonical procedures; the problem is to show the existence of quantum states corresponding with the particle-like solutions of the classical field equations. A plausible way to do this is suggested. – T. H. R. Skyrme. *Royal Society, Proceedings*, v. 262, ser. A, July 4, 1961, p. 237-245.

i • A Survey of Research on the **Transuranic Elements** – M. B. Waldron. *Contemporary Physics*, v. 2, no. 5, June 1961, p. 385-402.

j • **Heavy Water Moderated Power Reactors** Progress Report, March 1961 – The results of two-dimensional calculations of neutron flux distributions indicate that the maximum-to-average flux ratios can be maintained at lower values than were anticipated previously. If the calculations are verified by operating experience, a 10 to 20% increase in permissible reactor power may be achievable. Measured values of the nuclear parameters of a lattice of massive uranium elements in heavy water differ appreciably from calculated values. However, the differences partially compensate for one another so that the corresponding infinite multiplication constants for the lattice differ by only 4%.

k • Fission gases in irradiated fuel elements of compacted, fused uranium oxide in Zircaloy sheaths constituted only a minor fraction of the total gas released by the elements when the sheaths were punctured. It is concluded that the pressure ex-

erted by the fission gases during irradiation was not a factor in the irradiation failures of the elements. – R. R. Hood and L. Isakoff, compilers. *U. S. Atomic Energy Commission, DP-605*, May 1961, 65 pp. (UF767 Un3.1dp Contin.)

Analysis of Fueled **Irradiation Capsules** Which Failed in the Materials Testing Reactor – In the Fall of 1959, two instrumented irradiation capsules, containing NaK-bonded U - 10 wt.% Mo fuel, failed in the **Materials Testing Reactor** at Arco, Idaho. A detailed investigation of the incident indicated that the failures were probably caused by three primary conditions: an improper heat treatment causing sensitizing of the stainless steel capsule shell; excessively high local stresses adjacent to spacing rings; and an environment favorable to stress corrosion cracking. Means for avoiding the first two conditions are recommended. – D. G. Harrington. *U. S. Atomic Energy Commission, NAA-SR-4989*, June 15, 1961, 41 pp. (UF767 Un3.1na Contin.)

* Application of **Surface Barrier Solid State Ionization Chambers** to Measurements on Fission – Gold-silicon surface barrier detectors ~¾" in diameter have been made and used in several experiments on the fission process: used to measure the **mass distribution in fission** with thermal neutrons for several values of the total kinetic energy of the fragments; used for the measurement of the mass distribution in ternary fission; the ratio of ternary to binary fission for U^{235} fission with thermal neutrons was determined; the variation of the fission cross section of U^{238} with energy was measured for neutron energies in the range 6eV to 19eV. – Edward Melkonian. *Nuclear Instruments and Methods*, v. 11, May 1961, p. 307-315.

* On **Fine- and Hyperfine Structure** of **Americium-I** – It was previously described how hfs splitting constants can easily be obtained from experimental data by means of a graphical representation. Here it is shown that this method is also capable of conveniently and unambiguously determining the *J*-values of terms from hfs data. By application of this graphic evaluation method on known hfs measurements of the Americium 241 the undetermined *J*-value of one Am-I term could be obtained. In four other cases *J*-values were found which differ from the values known so far. The consequences of these redeterminations on the term analysis of the Am are discussed. (*In German.*) Zur Fein- und Hyperfeinstruktur des Americium-I. – K. Krebs and R. Winkler. *Zeitschrift für Physik*, v. 162, no. 3, 1961, p. 235-244.

Research Reactor Services – Describes **construction, operation and operating costs** of the **Battelle Research Reactor.** Compares **fuel reprocessing costs** with other operating costs. – J. N. Anno. Paper from "Institute of Nuclear Materials Management. First Annual Meeting, June 20-21, 1960", p. 15-28, 1960. Institute of Nuclear Materials Management, Pittsburgh. (TK9360 In7p)

Irradiation-Capsule Study for **SM-2 Reference and Alternate Dispersion Fuels** – Nominal 24 to 40 w/o highly enriched UO_2 dispersed in a matrix of Type 347 stainless steel, with burnable poisons in the form of B_4C, ZrB_2, NbB_2, or boron-10, and clad with Type 347 stainless steel are being evaluated for the SM-2 by capsule irradiation in high-flux positions at the MTR and the ETR. Irradiations of four capsules were completed early in 1960; maximum specimen burnups were approximately 40% of the total U atoms originally present. Temperature data from six current in-pile capsules indicate that the majority of the specimens now being irradiated are close to design temperature. Estimates of current burnup levels include consideration of specific uncertainties involved in the calculations and the measured burnup of specimens from the first capsules. – David B. Hamilton, John F. Lagedrost, Eugene M. Simons, and John H. Stang. *U. S. Atomic Energy Commission, BMI-1516*, May 25, 1961, 30 pp. + appendixes. (UF767 U3b Contin.)

MTR Gamma Heat Generation Measurements – Diagrams of the measuring devices; brief description of theory. Purpose: to combine all available data from previous measurements and to present it in a usable form. – L. D. Weber and C. H. Hogg. *U. S. Atomic Energy Commission, IDO-16652*, May 5, 1961, 39 pp. (UF767 Un3.1id Contin.)

* A Review of the Progress in **Research and Power Reactors** in the **"Outer Seven" Countries.** V – Data are tabulated. – J. R. Finniecome. *Mechanical World and Engineering Record*, v. 141, June 1961, p. 216-217.

Thermionic Reactor Systems – The possible concepts for utilizing thermionic cells with nuclear reactors are reviewed and the feasibility of their applications is discussed. Description of cesium cell and performance characteristics is also included. – R. C. Howard. *Nuclear Science and Engineering*, v. 10, June 1961, p. 173-182. a

* Nuclear Training and Research Equipment – A Vickers Mk. 1A **Reactor Simulator** is described in this article and meets all requirements for demonstrating clearly and comprehensively various nuclear and nuclear-physical processes. – Otto F. Joklik. *Nuclear Energy*, July 1961, p. 291-295. b

Reactor Core Temperature Measurement – Design and development of a thermocouple suitable for the measurement of temperature in a nuclear reactor core. The thermocouple junction is formed by applying thin films of tungsten and rhenium on a ceramic rod and coating these films with a ceramic insulating film. The thermocouple is capable of operating over a temperature range of 100 to 5000 F and has a response time of 50 to 100 millisec or less. Discussions of manufacturing methods and test results are presented. – L. H. Shinault and T. F. McGrath. *ARS Journal*, v. 31, June 1961, p. 799-803. c

Gamma-Ray Attenuation Factors for Angular Correlation and Angular Distribution Measurements – The angular resolution and azimuthal symmetry of an unshielded **NaI scintillation counter** was measured for gamma rays between 0.5 and 2.8 Mev in order to estimate correction factors needed in determining angular correlation functions. The results are in agreement with the corrections calculated by Rose, and extended by Stanford and Rivers, for similar scintillation crystal geometry. – D. W. Glasgow, L. W. Coleman, and L. Schecter. *Review of Scientific Instruments*, v. 32, June 1961, p. 683-684. d e

Reactions of **Graphite** With **Microwave-Activated Nitrogen.** Preliminary Report – R. C. Giberson. *U. S. Atomic Energy Commission, HW-68380*, Feb. 1961, 14 pp. (UF767 Un3.1hw Contin.) f

Nuclear Reactor Containment Buildings and Pressure Vessels – Proceedings of a symposium organized by the Department of Mechanical, Civil and Chemical Engineering of the Royal College of Science and Technology, Glasgow, May 17-20, 1960. The call for development in pressure vessels and containment buildings for nuclear reactors; the design and specification of **pressure vessels** and containment buildings in a nuclear reactor project; basic safety criteria for nuclear reactor containment; reinforced concrete as a material for containment; design of steel containment vessels in the U.S.A.; containment studies of the Enrico Fermi atomic power plant; stress analysis problems associated with the design of reactor pressure vessels; stress analysis of a containment vessel subjected to lateral loads; the influence line method of shell analysis; discontinuity problems in shell structures; experimental study of attachments to cylindrical and shallow spherical shells; elastic buckling of thin spherical shells; asymptotic solutions for the spherical shell subjected to axially symmetric loading; experimental investigation of the behavior of shallow spherical domes subjected to a variety of load actions; stress concentrations at the junction of a spherical pressure vessel and cylindrical duct caused by certain axisymmetric loadings; characteristic equations in the theory of circular cylindrical shells; theoretical investigation of the behavior of steel structures at elevated temperatures with particular reference to the stress relief of the Hunterston reactor pressure vessel; thermal stress in thin-walled circular cylinders; the steady creep of shells--a method of analysis; engineering design of containment buildings for nuclear reactors; fabrication and erection of heavy pressure vessels for the nuclear engineering industry; air testing of large, site constructed, reactor pressure vessels; analysis of brittle strength of a reactor vessel; brittle fracture behavior of metal structures. – Adam S. T. Thomson, et al, editors. 572 pp. 1960. Butterworth Inc., Washington, D. C. (TK9006 Sy68n) g h i j

Introduction to **Elementary Particle Physics** – This tract is very limited in its objectives. It concentrates on those aspects of elementary particle physics which do not depend on detailed dynamical calculations. Except for the last section of the book, distinct fields are associated with the well-established particles, the usual distinction is made between the strong, electromagnetic and weak interactions, and the only invariance prin- k

ciples and selection rules considered are those on a firm experimental footing. Even within this limited framework, no attempt is made to achieve rigor or completeness; instead, the physical meaning of the various concepts is emphasized and the experimental material is introduced chiefly for illustrative purposes; discussion of interactions; discrete transformations and selection rules; additive conservation laws; and isospin rotation and selection rules. – R. E. Marshak and E. C. G. Sudarshan. 231 pp. 1961. Interscience Publishers, New York. (QC721 M35i)

Effects of Irradiation Upon Hafnium Diboride – Natural **hafnium diboride** and hafnium diboride 55% enriched in boron-10 were irradiated in two capsules in the ETR to boron-10 burnups of about 25 to 50% at temperatures from 400 to 600 F. Major structural damage was revealed by X-ray diffraction examination, both diborides degrading to amorphous structures. Attempts to measure helium retention were unsuccessful. On the basis of the results obtained with the two capsules, neither the natural nor the enriched compound seems to offer much promise for control-rod applications. – Robert A. Ewing and Duane N. Sunderman. *U. S. Atomic Energy Commission, BMI-*1521, June 14, 1961, 7 pp. (UF767 U3b Contin.)

The Half-Life of **Rubidium-87** – A 4π proportional counter system capable of examining thin sources of extended area has been used to determine the half-life of ^{87}Rb, which was found to be $(5{\cdot}25 \pm 0{\cdot}10) \times 10^{10}$ years. – A. McNair and H. W. Wilson. *Philosophical Magazine*, v. 6, ser. 8, Apr. 1961, p. 563-572.

* Atoms for the Oilman. II. **Nuclear Reactors** of Interest to the **Petroleum Industry** – Some of the advantages of using oil produced heat in conjunction with nuclear heat are discussed, both for the purpose of presenting a basic description of nuclear reactors, as well as to discuss a potential future market for heating oil. – Richard E. Wainerdi. *Producers Monthly*, v. 25, no. 6, June 1961, p. 16-17.

* **Ground-State Properties** of Nuclear Matter – Concerns the development of an approximate method for treating the properties of large bound systems in their ground state and with the application of this method to idealized **nuclear matter.** The difficulties encountered in alternative perturbative approaches are considered in the introduction. – Robert Puff. *Annals of Physics*, v. 13, June 1961, p. 317-358.

The Half-Life of **Vanadium-50** – The half-life of the naturally occurring odd-odd isotope ^{50}V for electron capture decay to the first excited state of ^{50}Ti is shown to exceed 8×10^{15} years and for negatron decay to the first excited state of ^{50}Cr to exceed $1{\cdot}2 \times 10^{16}$ years. – A. McNair. *Philosophical Magazine*, v. 6, ser. 8, Apr. 1961, p. 559-561.

Progress Relating to Civilian Applications During April, 1961 – Gives status of work at Battelle on **nuclear reactor materials and components,** fuels, **radioisotope and radiation applications,** and recovery of spent fuel elements. – Russell W. Dayton and Clyde R. Tipton, Jr. *U. S. Atomic Energy Commission, BMI-*1514 (Del.), May 1, 1961, Sections individually paged. (UF767 U3b Contin.)

New **Reactor** Promises Competitive **Power** – Plant with 325,000-ekw. capacity to be built near San Francisco will give electricity at a cost below 6 mills per kilowatt-hour. – *Chemical & Engineering News*, v. 39, no. 28, July 10, 1961, p. 21-22.

* A Study of the Emission of **Negative Electrons** Accompanying β **and** α **Radioactivities** by the Coincidence Techniques – An effort was made to widen as much as possible the limits of use of the $(\beta - e^-)$ coincidence methods by developing a geometry and methods suitable for the elimination of the parasitic coincidences. By applying the **coincidence technique** to nuclear physics and by using pure β emitters, ^{35}S, ^{33}P, ^{147}Pn, RaE, and e^- spectrum coinciding with the β-radiation was revealed. (*In French.*) Étude de l'émission d'électrons négatifs accompagnant les radioactivités β et α, par la technique des coïncidences. – Maurice Duquesne. *Annales de Physique*, v. 6, ser. 13, nos. 5-6, May-June 1961, p. 643-702.

Creep Buckling of Stacked **Fuel Elements** – Equations are deduced from which bow in a rod forming part of an approximately vertical, pin-jointed column may be determined when there is slight tilt and initial bow in the rod and if the creep of the material under an applied load is known. – W. S. Blackburn. *Reactor Science and Technology*, v. 14, no. 1, Apr. 1961, p. 1-8.

a • A Study of the Feasibility of a Small Scale Reprocessing Plant for the **Dresden Nuclear Power Station** – Technical feasibility and economic evaluation of a **small-scale reprocessing plant;** hazards evaluation; conceptual plant. – H. Schneider, et al. *U. S. Atomic Energy Commission, IDO-*14521, Apr. 28, 1961, 119 pp. + 39 plates. (UF767 Un3.1id Contin.)

b • Steady-State **Nuclear Polarizations** via Electronic Transitions – Nuclear polarization schemes are surveyed. Special attention is given to those involving saturation of either the direct **electronic transitions** (Overhauser and "Underhauser" effects) or the weakly forbidden electron-nucleon "cross" transitions (Jeffries and Solid effects). Rate equations are used to find the power dependence of these effects. The physical systems allowing each of these effects are considered in terms of the various types of electron-nuclear coupling. Experimental work and bibliography to date are also surveyed. – Robert H. Webb. *American Journal of Physics*, v. 29, no. 7, July 1961, p. 428-444.

c • On the Emission of Fast Σ**-Hyperons** From Disintegrations Due to the Capture of K^--Mesons by Light Nuclei – A study has been made of those disintegrations produced in photographic emulsion by the nuclear capture at rest of **K⁻-mesons,** from which fast-charged Σ-hyperons are emitted. In a sample of 63 events, six were analyzed unambiguously as being due to absorption in C, N, or O without the emission of any neutrons. An additional eight were found to be consistent with **capture by a light nucleus** with the emission of one neutron only in each case. The fraction of disintegrations due to K^--meson capture in light nuclei from which a fast-charged Σ-hyperon is emitted has been estimated. Includes tables of data and calculated results. – D. Evans, et al. *Royal Society, Proceedings*, v. 262, ser. A, June 13, 1961, p. 73-83 + 4 plates.

d • For **Water-Cooled Power Reactors.** I. **Pumps.** II. **Valves.** III. **Heat Exchangers** – Offers a picture of what we have learned so far about these components and how this influences the design of equipment. – II. Kenneth H. Gruenwald. III. George T. Lewis, Jr., Michael Zizza, and Paul P. De Rienzo. *Nucleonics*, v. 19, July 1961, p. 53-80.

e • Dynamic Measurements of Low Magnetic Fields With Special Reference to the Strong Focusing 1.2 *GeV* **Electron Synchrotron** at Lund – A method employing "peaking strips" has been developed to **measure low magnetic fields** (up to $2{\cdot}10^{-2}$ Wb/m^2) with high accuracy. It has been used to obtain the injection time behavior of the magnetic field of a strong focusing electron synchrotron. – Hans Nysäter. *Kungliga Tekniska Högskolans Handlingar*, no. 174, 1961, 28 pp. (T4 K96t Vis.)

f • * Linear Effect of Applied Electric Field on **Nuclear Quadrupole Resonance** – Experimental evidence for the existence of a **linear Stark effect** which was predicted theoretically by one of us, has been found in the zero-field quadrupole resonance of Cl^{35} in $KClO_3$ and $NaClO_3$. – J. Armstrong, N. Bloembergen, and D. Gill. *Physical Review Letters*, v. 7, no. 1, July 1, 1961, p. 11-14.

g • * Helivity of μ^- **Mesons;** Mott Scattering of **Polarized Muons** – This experiment was designed to observe the helicity of the μ^- meson (and hence that of the associated $\bar{\nu}\mu$) from the reaction: $\pi^- \rightarrow \mu^- + \bar{\nu}\mu$. – Marcel Bardon, Paolo Franzini, and Juliet Lee. *Physical Review Letters*, v. 7, no. 1, July 1, 1961, p. 23-25.

h • * Angular **Beta-Gamma Correlation** to Beta Resonance and Interaction Types – The study of β-radioactivity was directed toward the determination of the type of interaction between the nucleons of a nucleus and the leptonic field whose particles are the electron and the neutrino. According to the linear approximation, 5 types of β-interaction were determined on the basis of the Dirac equation. The respective densities were examined by the angular β-neutron correlation, that is, by the angular β-γcorrelation to the resonance subsequent to **β-radioactivity.** A theoretical study of it was carried out in the case of the forbidden β-transitions of the first order, then this process was explained in the case of ^{76}As. (*In French.*) Corrélation angulaire bêta-gamma a la résonance et types d'interaction bêta. – Maurice Spighel. *Annales de Physique*, v. 6, ser. 13, nos. 5-6, May-June 1961, p. 535-594.

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• Instability of Charged Particles Beam in **Electron Plasma** – The instability is studied as a result of the excitation of longitudinal electron vibrations. The directed velocity of the motion of the particles beam is assumed to be much higher than the average heat velocity of the electrons of the plasma. A solution is given of the corresponding dispersion equation as a function of the relationship of the densities and of the heat dispersion of the speeds of the particles beam and of the electrons of the plasma. (*In Russian.*) Analiz neustoĭchivosti puchka zariazhennykh chastits v elektronnoĭ plazme. – V. S. Imshennik and Iu. I. Morozov. *Zhurnal Tekhnicheskoĭ Fiziki*, v. 31, no. 6, June 1961, p. 640-649.

• A Theory of **Leptons** – A unified model is proposed for the electron and muon, where the two leptons form an *M*-doublet. The theory is based on the symmetrization of the mass term in the equation of a spinor field, that has also a certain self-coupling. This spinor field has two different rest-mass states that are identified with the electron and muon. The four-component neutrino is a special case in this *M*-doublet model. The nonconservation of parity in the weak interaction is a consequence of the *M*-symmetry principle. The fundamental leptonic weak current is of the type *V* only, and thus resembles exactly the electron-muon electric current. The neutrinos coupled to the electron and muon in the weak current are two particles of opposite helicity, which are the two members of a four-component neutrino. The existence of solutions of the fundamental field equation in monochromatic plane waves is proved. The theory causes no modification on the classic results and conclusions of the usual electron theory in atomic physics. Possible generalization of the *M*-doublet model to baryons and mesons is also discussed. (*In French.*) Une théorie des leptons. – K. H. Tzou. *Journal de Physique et le Radium*, v. 22, no. 5, May 1961, p. 257-266.

Directional High Energy **Gamma-Ray Counter** – A directional Čerenkov counter has been developed for detection of energetic gamma rays from balloons and satellites. It is sensitive to photons whose directions lie within a 10° cone. It is completely insensitive to backward fluxes and almost completely insensitive to charged particles. Several different versions of the system have been constructed, and tested in bremsstrahlung beams. The angular resolution has also been indirectly confirmed by using the device to count cosmic ray muons at sea level. Theory, design, and performance. – G. G. Fazio and E. M. Hafner. *Review of Scientific Instruments*, v. 32, June 1961, p. 697-702.

Heavy-Ion Linear Accelerator – Two linear accelerators have been built for the acceleration of ions in the mass region from He to Ar. The linear accelerators consist of two 70-Mc cavity resonators of the Alvarez design. Ions with a charge to mass ratio $e/m \geq 0.15$ times the e/m of a proton are injected into the first cavity of the linear accelerator with a Cockcroft-Walton accelerator. In the first cavity the ions are accelerated from the injection energy of 0.57 Mev/nucleon to 1.0 Mev/nucleon. They are then stripped to an $e/m \geq 0.3$ and accelerated to the final energy of 10 Mev/nucleon in the second linac cavity. Ion source, buncher, R. F. system, etc., are discussed. – E. L. Hubbard, et al. *Review of Scientific Instruments*, v. 32, June 1961, p. 621-634.

Neutron Spectrometer for Producing Pure **Monochromatic Beams in the Thermal Region** – The combination of a Si (111) monochromator and a quartz "single-crystal" filter proves effective for the elimination of higher-order contamination from the monochromatic beam of a neutron crystal spectrometer in the energy range from ~0.02-0.10 ev. This system greatly enhances the usefulness of crystal spectrometers for obtaining cross-section data in the thermal range. The properties of the quartz filter have been studied at room temperature and 77 K, and it is shown that the filter is more efficient in this application at room temperature. The higher-order contaminations from Si (111) and NaCl(200) reflections are compared, and it is clearly demonstrated that Si (III) is a superior monochromator in the thermal region. – H. Bjerrum Møller, F. J. Shore, and V. L. Sailor. *Review of Scientific Instruments*, v. 32, June 1961, p. 654-658.

Pulse Shape Discrimination in **Stilbene Scintillators** – A simple, sensitive **pulse shape discriminator** is described, which was designed to permit detection of low energy neutrons in the presence of a very high γ-ray background, and at high counting rates. An improvement relative to discrimination circuits published so far was obtained by incorporating a fast crystal diode switch for the separation of the fast and slow parts of the scintillator deexcitation pulse. This device greatly reduces interference effects of nearly coincident detector pulses and also permits better pulse matching and comparison. The best discrimination was obtained for moderate sensitivity and counting rates, where out of 10^5 detected γ-rays, about one was erroneously omitted. A detailed description of the circuit and accessories is given, and results of test runs at a 20 Mev FM cyclotron are presented. – W. Daehnick and R. Sherr. *Review of Scientific Instruments*, v. 32, June 1961, p. 666-670.

Effects of Diffusion in **Nuclear Magnetic Resonance** Spin-Echo Experiments – The **spin-echo attenuation** by molecular **self-diffusion** in an inhomogeneous magnetic field has been calculated for three- and four-pulse sequences. The method employed avoids the question of an averaging procedure as discussed by Das and Saha. Experimental measurements yield confirmation of the three-pulse results. – D. E. Woessner. *Journal of Chemical Physics*, v. 34, June 1961, p. 2057-2061.

Special Features of the **Brown Boveri-Krupp Reactor** – Safety; heat transfer; power control; and steam generator. – O Machnig, J. Binckebanck, U. Hennings, and R. Küster. *Nuclear Power*, v. 6, Mar. 1961, p. 63-66.

The **Kahl Nuclear Power Station:** Zero Power Tests and Planned Modifications – Designed to provide a flexible instrument for studying performance under all types of BWR operation. – Hans-Joachim Brüchner. *Nuclear Power*, v. 6, Mar. 1961, p. 67-70.

The **Siemens Multi-Purpose Reactor** Design – Albert Ziegler. *Nuclear Power*, v. 6, Mar. 1961, p. 71-74.

The **Interatom Marine Reactor** Design – Safety and flexibility, rather than low cost. – F. E. Faris. *Nuclear Power*, v. 6, Mar. 1961, p. 75-76.

Radiation Monitoring for the Protection of Personnel – International survey of equipment designed to detect and measure ionizing radiation. *Nuclear Engineering*, v. 6, July 1961, p. 285-298.

Belgium's Novel Research Reactor–BR-2 – A detailed description of the **Belgium reactor** design was presented at the 1958 Geneva Conference and although in principle, the design is still the same, in detail some changes have been made, notably in the fuel elements and in the internal arrangements of the reactor vessel. *Nuclear Engineering*, v. 6, July 1961, p. 276-280.

• A Method of **Identifying Charged Particles** – It consists of a combination of a magnetic field and nuclear emulsions. – B. Forkman and S. A. E. Johansson. *Arkiv för Fysik*, v. 19, nos. 2-3, 1961, p. 99-107.

• **Beta-Gamma Directional Correlation** in Rb^{86} – The directional correlation of the once-forbidden, non-unique 700 keV beta group with the 1.08 MeV gamma-ray in the decay of **Rb^{86}** has been measured as a function of beta energy from 100 keV to 600 keV. – J. H. Hamilton, B. -G. Pettersson, and J. M. Hollander. *Arkiv för Fysik*, v. 19, nos. 2-3, 1961, p. 249-257.

• Proceedings of the International Symposium on **Polarization Phenomena** of **Nucleons** – P. Huber and K. P. Meyer, editors. *Helvetica Physica Acta Supplementum* VI, 1961, 435 pp.

Diffusion Length of **Thermal Neutrons** in Water From 23°C to 244°C – Values reported are compared with a theoretical model which calculates the transport mean free path and the absorption cross-section averaged over the velocity weighted neutron spectrum. – M. Reier and J. A. deJuren. *Reactor Science and Technology*, v. 14, no. 1, Apr. 1961, p. 18-24 + 2 plates.

• Now–A **Mobile Nuclear Power Plant** – ML-1 is designed to operate 10,000 hours without refueling or overhaul. *Power Engineering*, v. 65, July 1961, p. 72.

• **Radiation Effects** in Polystyrene – Amorphous **polystyrene** was subjected to nuclear radiation in doses ranging from 1.2 x 10^{10} to 3.8 x 10^{11} ergs per gram. At low irradiation doses cross-linking occurred sufficient for the formation of a non-liquefying, three-dimensional network in the polystyrene, but no changes in the dynamic mechanical properties attributable to irradiation could be detected. – Donald E. Kline. *Journal of Applied Polymer Science*, v. 5, no. 14, Mar.-Apr. 1961, p. 191-194.

• The Neutron Deficient **Iridium Isotopes** Ir^{182}, Ir^{183} and Ir^{184} – Produced by irradiations with the Berkeley heavy-ion linear accelerator. By means of timed chemical separations, NaI scintillation spectrometers and proportional counters, half lives have been determined as follows: Ir^{182}, 15 ± 1 min; Ir^{183}, 55 ± 7 min; Ir^{184}, 3.2 ± 0.2 hr. The gamma-ray spectra of Ir^{182} and Ir^{184} are very complex, each extending above 4 MeV. – R. M. Diamond, J. M. Hollander, D. J. Horen, and R. A. Naumann. *Nuclear Physics*, v. 25, no. 2, May 1961, p. 248-258.

• The **Elastic Scattering** of **29 MeV ^{3}He-Particles** by Cl, Kr and Xe – Angular distributions using a photographic plate method. Absolute differential cross-sections for elastic scattering are given in the center-of-mass system in the angular range 14° to 80°. The experimental results are analyzed in terms of the optical model of the interaction and best fit parameters of this model are obtained. – J. Aguilar, A. García, J. B. A. England, P. E. Hodgson, and W. T. Toner. *Nuclear Physics*, v. 25, no. 2, May 1961, p. 259-265.

• The **$B^{10}(d, n)C^{11}$ Reaction** – Neutron groups from the reaction $B^{10}(d,n)C^{11}$ were studied at deuteron energies of 1.2, 3 and 4 MeV using time of flight techniques. The results are compared with those for the $B^{10}(d, p)B^{11}$ reaction and with Butler stripping theory for the intermediate coupling shell model. – A. N. James, A. T. G. Ferguson, and C. M. P. Johnson. *Nuclear Physics*, v. 25, no. 2, May 1961, p. 282-291.

• Absolute **Measurement of Energy** of the Most Important Natural **Alpha Ray Emitters** – With the help of a 180° spectrograph in a large permanent magnet, some of the most important alpha energies are absolute and were determined anew with high accuracy for Po^{210}, Po^{212}, Po^{214}, Bi^{212}, Bi^{211}, Ra^{223}, Rn^{219} and Po^{215}. The exactly corrected magnetic field was measured with proton resonance and the diameters of orbits were compared with a standard radiation rod. (*In German.*) Absolutmessung der Energie der wichtigsten natürlichen Alpha-Strahler. – Albrecht Rytz. *Helvetica Physica Acta*, v. 34, no. 3, 1961, p. 240-264 + 1 plate.

• Internal Bremsstrahlung in **$O^- \rightarrow O^+$ Beta-Transitions** – It is shown that experimental investigations of the energy dependence of the degree of circular polarization of the **internal bremsstrahlung** quanta would allow the determination of the possible role of pseudo-scalar interaction in nuclear β-decay. – František Janouch. *Nuclear Physics*, v. 25, no. 2, May 1961, p. 328-332.

Direct Cycle **Diphenyl Reactor** – This 20 MW graphite moderated, uranium monocarbide fueled and diphenyl cooled nuclear reactor concept using a direct power conversion cycle is claimed to be competitive with conventional steam plants. *Nuclear Power*, v. 6, July 1961, p. 86.

Spin-Change Cross-Sections – A quantal formulation of **spin-change processes in** collisions of atomic systems is presented. The cross-section for the spin-change process in the collision of two hydrogen atoms is computed for temperatures up to 10,000 K and the results given in a table. – A. Dalgarno. *Royal Society, Proceedings*, v. 262, ser. A, June 13, 1961, p. 132-135.

Institute of **Nuclear Materials Management.** First Annual Meeting, June 20-21, 1960 – Papers cover nuclear materials management, methods of **determining U-235 in fuels** using a scintillation spectrometer, **uranium scrap processing** activities, and integrated power **fuel processing.** – 147 pp. 1960. Institute of Nuclear Materials Management, Pittsburgh. (TK9360 In7p).

• **Nuclear Power Plant** . . . The Industry Could Have One by '64 – A.E.C. built process-heat nuclear reactor will be leased to private industry for power. Discussion of cost and feasability. Basic operation explained. – S. B. Burwell and C. S. Burtnette. *Pulp & Paper*, v. 35, no. 12, June 12, 1961, p. 57-59.

a Charge-Exchange Production of **Antineutrons** and Their **Annihilation in Hydrogen** – A separated beam of antiprotons was sent into the 72-inch H bubble chamber. The charge exchange of antiprotons into antineutrons and the subsequent annihilation of the antineutrons were observed in the bubble chamber. The **antiprotons** were produced internally in the Bevatron; channeled externally by collimation, quadrupole b focusing magnets and bending magnets, and separated from other negatively charged particles by a system of three velocity spectrometers. The ratio of the number of annihilations containing five charged pions to the number containing three charged pions, and the momentum distribution of the pions, have been compared with predictions of the statistical model. – C. Keith Hinrichs. *U. S. Atomic Energy Commisison, UCRL-9589*, Mar. 14, 1961, 83 pp. (UF767 U3u Contin.)

c • Gamma-Ray Angular Correlations From **Aligned Nuclei** Produced by **Nuclear Reactions** – Two general procedures are described which have wide application in nuclear spectroscopy for the determination of **spins and gamma-ray multipolarities.** Cases can be studied by these methods when the reaction proceeds through a compound state too complex to allow the usual d analysis to be made, for example, where several levels overlap or where direct interaction is dominant. – A. E. Litherland and A. J. Ferguson. *Canadian Journal of Physics*, v. 39, June 1961, p. 788-824.

• A **Nuclear-Thermionic Convertor** – A nuclear-heated thermionic diode, consisting of a uranium carbide cathode and copper anode, produced 90 W of electricity at efficiencies and power e densities adequate for practical applications is announced and described. – R. C. Howard. *Institution of Electrical Engineers, Journal*, v. 7, no. 77, May 1961, p. 284-286.

• **Instrumentation and Control** of **Nuclear Reactors.** Scottish Centre Electronics and Measurement Group Symposium – E. Openshaw Taylor. *Institution of Electrical Engineers, Journal*, v. 7, no. 77, May 1961, p. 281-283.

f **Neutron Scattering** From **Isotropic Lattices** – A model based on the Born von Karman theory of lattice vibrations is applied to the above problem. Some of the integrals involved cannot be evaluated analytically and are, therefore, computed on the T.I.F.R. electronic computer. – R. Subramanian. *Physics and Chemistry of Solids*, v. 19, nos. 3-4, May 1961, p. 173-180.

g Era of Nuclear Space APU's Arrives – **Satellites** carrying SNAP-type **isotopic power sources** can be used as an accurate navigational reference and time source. – Hal Gettings. *Missiles and Rockets*, v. 9, no. 2, June 10, 1961, p. 12-13.

• The Level Structure and Electromagnetic Structure of the **Nucleon** – The **level scheme** of the nucleon; theory of the excited levels of the nucleon; optical property of the nucleon; h **electromagnetic structure** of the nucleon; theory of the electromagnetic structure of the nucleon I - isovector part, II - isoscalar part. – Masaaki Kato and Gyo Takeda. *Fortschritte der Physik*, v. 9, nos. 2-3, 1961, p. 51-105.

Apparatus for Measuring **α-Particle** Ranges in Liquids – An apparatus for measuring the **range in liquids** of α-particles from radioactive substances is described. Its accuracy is about 1‰ i for measurements of ranges of the order of 50 micron. – Gunnar Aniansson. *Kungliga Tekniska Högskolans Handlingar*, no. 177, 1961, 43 pp. (T4 K96t Vis.)

• **Nuclear Orientation** of Dy^{155} and Dy^{157} – The isotopes **Dy^{155}** and **Dy^{157}** were aligned at low temperatures in a single crystal of neodymium ethyl-sulfate, using the magnetic hfs method. Angular distribution of gamma radiation following the j decay of these isotopes was studied as a function of temperature in the region $0.02\ K < T < 1K$. Spin assignments of $\frac{5}{2}$ were made to states at 227 kev in Tb^{155} and at 327 kev in Tb^{157}. – Quirino O. Navarro and D. A. Shirley. *Physical Review*, v. 123, 2nd ser., no. 1, July 1, 1961, p. 186-189.

k In^{116} **Activation Ratios** – The data of Domanic and Sailor regarding the ratio of the 54-min to the 13-sec activities of **In^{116}** produced by neutron capture in In^{115}, previously published,

have been corrected with experimentally determined self-absorption factors for 54-min In^{116}. The results of these corrections have removed an anomaly observed between foils of different thicknesses, provided the foil is known to have been uniformly activated throughout its volume. The corrections appear to have removed a dependence of the ratio of activities on neutron energies from thermal to 2.66 ev. – M. A. Greenfield and R. L. Koontz. *Physical Review*, v. 123, 2nd ser., no. 1, July 1, 1961, p. 197-198.

Half-Life of **Samarium-147** – A liquid **scintillation counting technique** has been applied to the determination of the **half-life** of Sm^{147} by specific alpha activity measurement. A value of $(1.05 \pm 0.02) \times 10^{11}$ years is obtained. – P. M. Wright, E. P. Steinberg, and L. E. Glendenin. *Physical Review*, v. 123, 2nd ser., no. 1, July 1, 1961, p. 205-208.

° Use of **$CaSO_4$-Sm Phosphor** in Dosimetry – It was shown that $CaSO_4$-Sm phosphor, while inferior to the $CaSO_4$-Mn phosphor in as far as the registration of the minimum dose is concerned, conserves considerably longer the accumulated light sum. This makes it expedient to use $CaSO_4$-Sm phosphor in **radiation dosimetry** at raised temperatures (up to 100°) in protracted measurements. (*In Russian.*) Primenenie fosfora $CaSO_4$-Sm dlia tselei dozimetrii. – A. P. Krasnaia, B. M. Nosenko, L. S. Revzin, and V. Ia. Iaskolko. *Atomnaia Energiia*, v. 10, no. 6, June 1961, p. 630-631.

° **Thermodynamic Cycles** of **Nuclear Power Stations** – Discussion of the preliminary determination of the average optimal temperature of the heat supply to the atomic electric power plants. (*In Russian.*) K voprosu o termodinamicheskikh tsiklakh atomnykh elektrostantsii. – D. D. Kalafati. *Atomnaia Energiia*, v. 10, no. 6, June 1961, p. 623-624.

° **Reactor Core Materials** – A review of recent developments in the fields of fuel and fertile materials, moderator materials, nuclear poisons, cladding and structural materials, and special fabrication techniques. *Reactor Core Materials*, v. 4, no. 2, May 1961, 64 pp.

° **Transient Temperature** Distribution of the Cylindrical **Fuel Element** in the Case of Boundary Conditions Being Time Dependent – The solution of the partial differential equations describing thermal processes in the fuel-channel of the reactor core is the scope of this paper. These equations are solved with respect to the fuel-element temperature. – Wiesław Ciechanowicz. *Nukleonika*, v. 6, no. 5, 1961, p. 317-324.

° Partial Fuel Reloading Modes in Nuclear Reactors – In the article is considered the problem of the effect of **partial nuclear fuel recharging** on the **burn-up fraction of U** in the working reactor channels. (*In Russian.*) Rezhim chastichnykh peregrusok goriuchego v iadernykh reaktorakh. – E. I. Grishanin, B. G. Ivanov, and V. N. Sharapov. *Atomnaia Energiia*, v. 10, no. 6, June 1961, p. 565-571.

° Theory of the Effects of **Irradiation** on Some Properties of **Graphite** – Calculation of the change of the lattice constant and internal energy of a volume unit of graphite crystal containing Frenkel defects. Results are compared with the experimental data. (*In Russian.*) K teorii vlianiia oblucheniia na nekotorye svoistva grafita. – V. M. Agranovich and L. P. Semenov. *Atomnaia Energiia*, v. 10, no. 6, June 1961, p. 572-576.

OPERATIONS RESEARCH

Supervisors in Action. Developing Your Skills in Managing People – Joseph J. Famularo. 238 pp. 1961. McGraw-Hill, New York. (HF5549 F21s)

How **Industrial Engineering** Helps to Cut Costs at Calumet & Hecla – **Cost reduction** is defined in C&H's terms as that reduction derived from methods improvements, such as a change in equipment which allows reduction in labor. The procedure is divided at C&H into "developed" and "installed" cost reduction; the latter where a plan has been put in place and the former where a plan has been investigated, analyzed, and tested on the planning board. – Roger F. Bredin. *Engineering and Mining Journal*, v. 162, July 1961, p. 70-72.

Linear Programming Applied to Linear Differential Equations – Describes the numerical solution of **linear differential equations** by linear programming. – Jonathan D. Young. *U. S. Atomic Energy Commission, UCRL*-9498, Jan. 17, 1961, 10 pp. (UF767 U3u Contin.)

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° Jersey Standard . . . Chemical Success With a **Management Structure** That 'Simply Couldn't Work' – Jersey proves that a **complex, far-flung network** of manufacturing facilities and marketing affiliates can be closely knit and well-coordinated. – John Mellecker. *Chemical Processing*, v. 24, July 1961, p. 23 + 7 pages.

b

The Shine on the Gray Flannel Suit – Many managers are now beginning to question whether the strict controls and highly directive approach of the typical large **business organization** are not based on a picture of man that is, at least partly, distorted. – Eugene Raudsepp. *Management Review*, v. 50, July 1961, p. 4-12.

c

° Operational Methodology for Evaluating **Physiological Costs** – Preliminary research activity in a proposed long-range program to study **human energy expenditures** in industrial operations. The motivation is that of providing a fund of knowledge which will permit the industrial engineer to improve his decision activities. – David S. Ekey and Thomas J. Hall. *Journal of Industrial Engineering*, v. 12, no. 4, July-Aug. 1961, p. 243-252.

d

ORE AND MATERIALS BENEFICIATION

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Preparing **Nickel and Cobalt Concentrates** – Nickel, Co, and Zn can be selectively and rapidly precipitated from acidic ore leach liquors by H_2S at moderate temperatures and pressures. The thermodynamics of the reactions are developed, and the role of inert cations on equilibrium conversion is demonstrated. – Tuhin K. Roy. *Industrial and Engineering Chemistry*, v. 53, July 1961, p. 559-566.

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Flotation of **Spodumene-Beryl Ores** – Covers laboratory and pilot-plant tests. – James S. Browning. *Mining Engineering*, v. 13, July 1961, p. 706-708.

Flotation Used to Concentrate **Beryllium Ore** – Beryllium Resources, Inc., develops commercially feasible concentration process; will build Utah plant. *Chemical & Engineering News*, v. 39, no. 27, July 3, 1961, p. 46.

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Laboratory Development of a **Tributyl Phosphate Solvent Extraction** Process for Processing 20% **Enriched Uranium Alloy Fuel** – J. H. Goode and J. R. Flanary. *U. S. Atomic Energy Commission, ORNL*-2855, June 1, 1961, 25 pp. (UF767 U3o Contin.)

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Defluorination of **Siliceous Fluorspars** at Elevated Temperatures – Studies on solid-state defluorination (laboratory scale) and tests on molten defluorination (intermediate scale) of siliceous fluorspars. The studies were made to develop a pyrohydrolytic process for liberating F from offgrade fluorspars. – Arden D. Fugate and Lloyd H. Banning. *U. S. Bureau of Mines Report of Investigations* 5809, 1961, 23 pp. (TN21 Un3r Room 290)

i

Selective **Flotation** of Fine-Grained **Lead-Zinc Sulfides** From Idaho and Washington – Found that flotation could be effectively applied to the selective recovery of exceedingly fine-grained lead and zinc sulfide minerals. Separation of galena and sphalerite was obtained on pulps ground through 1,600-mesh, in which most of the particles were smaller than 5 microns. Application of a dye in treatment of two other very fine-grained ores yielded lead concentrates containing over 62% Pb at recoveries in excess of 85%. – A. E. J. Gallagher, W. A. Stickney, J. E. Shelton, and F. W. Wessel. *U. S. Bureau of Mines Report of Investigations* 5765, 1961, 20 pp. (TN21 Un3r Room 290)

j

Bringing Home **Beryllium.** New Ore-Treating Techniques Are Claiming Elusive Beryllium From Utah's Spors-Topaz Mountains – **Flotation** process; acid extraction process. – *Chemical Week*, v. 88, no. 26, July 1, 1961, p. 35 + 2 pages.

k

* The Treatment of **Tin Ores** in the **Rooiberg Concentrator** – R. C. M. van der Spuy. *South African Institute of Mining and Metallurgy, Journal,* v. 61, no. 10, May 1961, p. 468-488.

Beneficiation of **Ferruginous Sandstones** of the Northampton Sand Ironstone Formation – Laboratory investigations indicate that a high proportion of the silica can be removed by ore dressing to give a concentrate with an analysis at least equivalent to and perhaps rather better than the ironstone at present mined. – G. E. Davies. *Iron and Steel Institute, Journal,* v. 198, pt. 3, July 1961, p. 282-289.

Britain Declassifies **Protactinium Extraction** – Describes 12-stage process that produced 125-gram supply from ether sludge accumulated during pitchblende processing. *Chemical & Engineering News,* v. 39, no. 32, Aug. 7, 1961, p. 48-49.

* **Beneficiation** of **Manganese Ores** With Particular Reference to the Treatment of a Low Grade Ore From Viti Levu, Fiji – Test work on a sample of ore from a low-grade deposit in S.W. Viti Levu showed that a marketable Mn concentrate could not be produced from this ore by gravity concentration or flotation even though a low Mn recovery may be acceptable. – M. H. Buckenham. *New Zealand Journal of Geology and Geophysics,* v. 4, no. 2, May 1961, p. 136-147.

* **Crushing and Grinding** Calculations. II – Concerns a number of factors affecting the grinding process and the life of equipment, such as the fraction of mill volume occupied by the grinding charge, the quantities of rods and balls to be contained in a mill, wear of mill and grinding medium, and mill speed in terms of the critical speed. – Fred C. Bond. *British Chemical Engineering,* v. 6, Aug. 1961, p. 543-548.

PHYSICS

* Couette Flow of a Fully **Ionized Gas,** Considered as a Two-Component Fluid – The equations, governing the behavior of a fully ionized gas, as given by Spitzer, are applied to two types of magnetohydrodynamic **Couette flow.** The features of the flow are expressed in terms of the Hartmann number and a parameter q, being the ratio between Larmor frequency and collision frequency. Compared with the results of the one-component theory an additional velocity component is found. – L. A. Peletier and L. van Wijngaarden. *Applied Scientific Research, Sec. B, Electrophysics, Acoustics, Optics, Mathematical Methods,* v. 9, no. 2, 1961, p. 141-150.

On the **Quantum Statistical Basis** of Non-Equilibrium **Thermodynamics.** I – The quantum statistical theory of Wigner distribution functions is developed to serve as a basis for the derivation of the Onsager reciprocal relations in non-equilibrium thermodynamics. The theory is closely analogous to the classical treatment, given by de Groot and Mazur. – J. Vlieger, P. Mazur, and S. R. de Groot. *Physica,* v. 27, Apr. 1961, p. 353-372.

* Three-Dimensional Relativistic **Schrodinger's Equation** for the **Problem of Two Bodies** – The work deals with a relativistic generalization of the Schrodinger's Equation without increasing the number of independable variables. Schrodinger's equation is constructed according to the concept of velocities. From the appearance of the equation obtained, it is clear that its internal symmetry corresponds to the group of three-dimensional rotations. (*In Russian.*) Trekhmernoe relativistskoe uravnenie Shredingera dlia zadachi dvykh tel. – Iu. A. Gol'fand. *Akademiia Nauk SSSR, Doklady,* v. 138, no. 2, May 1961, p. 331-333.

Cyclotron Resonance in **Bismuth.** II – Preliminary work has been extended in order to check the detailed form proposed for the electron energy band, and to look for evidence of resonances from the holes. At high fields ($H \geq 2000$G), the surface resistance, R, is found to pass through a minimum, and then to increase with H. – J. E. Aubrey. *Physics and Chemistry of Solids,* v. 19, nos. 3-4, May 1961, p. 321-330.

* Lifetimes of Fast **Ions** in the **Plasma** of DCX – Reports the results of recent lifetime studies for protons trapped in DCX via the latter mechanism, gas dissociation, which show mean-containment times in the order of seconds at initial proton densities of 10^7 cm^{-3}. – C. F. Barnett, et al. *Physical Review Letters,* v. 6, no. 11, June 1, 1961, p. 589-591.

* Mechanism of the Magnetoelectric Effect in an **Antiferromagnet** – Proposes a simple phenomenological theory of the temperature dependence of the **magnetoelectric effect.** – George T. Radio. *Physical Review Letters,* v. 6, no. 11, June 1, 1961, p. 609-610.

Thermodynamic Properties of an **Isotopic Mixed Crystal** – An expression of the frequency distribution of the crystal formed by a single element possessing several isotopes is applied to the computation of the **thermodynamic properties** changes resulting from the isotope mixing. – Jean Pirenne. *Physica,* v. 27, Apr. 1961, p. 385-402.

Modulation of Light by Means of an **Electric Field** – B. H. Claussen. *Physical Society, Proceedings,* v. 77, pt. 5, May 1961, p. 1100-1101.

Satellite Might be Used to Verify **Einstein's Theory of Gravity** – Stanford's Prof. Schiff is proposing that a gyroscope be orbited to look for the axis precession which must exist under Einstein's laws. Schiff wants to find an experimental test of a gravitational nature that will be predicted correctly only by Einstein's theory. – Robert L. Forward. *Missiles and Rockets,* v. 9, no. 2, July 10, 1961, p. 32 + 1 page.

* **Thermodynamic Properties** of **Sodium** and Its **Vapor** – A compilation of experimental data knitted together with theoretical calculations believed to be accurate enough for most design uses; vapor pressure data; dimerization; enthalpy; latent heat of vaporization; Mollier diagram. – E. L. Dunning. *Power,* v. 105, July 1961, p. 77-81.

* Causality Condition and the Unlocal Nature of the Lagrangean in **Quantum Electrodynamics.** (*In Russian.*) Uslovie prichinnosti i nelokal'nost Lagranzhiana v kvantovoi elektrodinamike. – V. A. Shcherbina. *Akademiia Nauk SSSR, Doklady,* v. 138, no. 1, May-June 1961, p. 93-95.

* On Six New Relations Between the Elastic Constants of **Crystals** – It is shown that in those cases where Laval's scheme of 45 **elastic constants** is applicable, there are six relations that must be satisfied by the elastic constants. These relations follow from an analysis of the body-couples and of the strain-energy function. As a consequence the number of independent elastic constants of a triclinic crystal is reduced from 45 to 39; reductions also take place in the other crystal classes. The new elastic matrices are given for each of the 11 Laue-groups and for isotropic solids. There is also a discussion on the various assumptions that have been made by different authors regarding the rotational invariance of the strain energy. – N. Joel and W. A. Wooster. *Acta Crystallographica,* v. 14, pt. 6, June 10, 1961, p. 571-578.

Heat Transfer, Buffalo – Volume contains 20 papers selected from those presented at the Fourth National Heat Transfer Conference held in Buffalo, New York, Aug. 14-17, 1960. The conference was sponsored jointly by the American Institute of Chemical Engineers and the American Society of Mechanical Engineers. Thermal diffusivity of solid materials by an unsteady state method, radial effective conductivity and the wall effect, fluid-to-particle heat transfer, heat transfer and pressure drop in two-phase flow, subcooled nucleate boiling, and various papers on transfer between two phases. v. LVII. 210 pp. 1961. American Institute of Chemical Engineers, New York. (QC320 Am35he)

Emission of **Radio-Frequency Waves** From **Plasmas** – Observations of the radio-frequency emission from extraterrestrial plasmas and plasmas produced in the laboratory are described, and various attempts at interpretation of the results are reviewed. Estimates are made of the probable loss of radiant energy from plasmas in proposed thermonuclear reactors; thermal radiation: bremsstrahlung; cyclotron emission from orbital acceleration, from energetic electrons; macroscopic model of noise emission; radiation from Landau pumping; nonthermal radiation: plasma oscillations; cyclotron emission from electrons in non-Maxwellian distributions; amplification of nonthermal radiation; measurement of radio frequency noise from plasmas. – G. Bekefi and Sanborn C. Brown. *American Journal of Physics,* v. 29, no. 7, July 1961, p. 404-428.

Fibre Optics – Nontechnical explanation with examples. Applications. – Narinder S. Kapany. *Research/Development,* v. 12, July 1961, p. 64-73.

• Average Forces in **Electromagnetic Systems** – The mechanical forces developed in electromagnetic systems are usually evaluated from surface integrals of the Maxwell stresses. For a large class of systems it is shown that the **time average force** can be expressed in terms of directly measurable circuit-theory parameters. The system must be linear and loss free, and there is no restriction on the frequency of excitation. – W. E. Smith. *Australian Journal of Physics*, v. 14, no. 1, Mar. 1961, p. 152-159.

Shock Waves in a **Plasma** – Some of the recent analytical work on **shock waves** (normal) in a fully-ionized plasma are reviewed. Emphasis is on the physical nature of the problem, such as the speed of sound, shock structure, temperature equalization between the electrons and ions. Some special features of this problem and possible direction of further research are indicated. – K. T. Yen. *General Electric Company, Technical Information Series, No.* R61SD089, June 1961, 14 pp. (T1 G28t Contin.)

On the Approximate Calculation of **Heat Transfer** by **Laminar Flow** From a Rotating Heated Disk at Prandtl Numbers Between 0·2 and 6 – D. R. Davies and C. B. Baxter. *Quarterly Journal of Mechanics and Applied Mathematics*, v. 14, pt. 2, May 1961, p. 223-228.

The Role of Materials in **Cryogenics** – How and where materials are being used in cyrogenic solid state devices. How engineering properties are affected by ultra-low temperatures. How to evaluate and test materials for cryogenic applications. – Donald Peckner and Malcolm W. Riley. *Materials in Design Engineering*, v. 54, no. 1, July 1961, p. 107-118.

• **Interference Spectroscopy** – Sensitivity gain of more than 1000 in new **infrared spectrometer**. *Electromechanical Design*, v. 5, no. 7, July 1961, p. 26 + 2 pages.

• **Infrared and Photo Detection** – This digest will be concerned with the comparatively simple and inexpensive applications of infrared and photodetectors in commercial and industrial equipment. *Electromechanical Design*, v. 5, no. 7, July 1961, p. 41-54.

• **Electron Liberation** by Low Energy Ions in **Gas-Covered Metal Surfaces** – Describes a method of measuring the gamma$_1$-effect (electron liberation by ions in surfaces) important for independent electric charges as a function of E/p without any photoelectric disturbances. All rare **gas ions** and some molecule gas ions (H_2, O_2, N_2) were used. Copper was used as a target, whose surface condition had been modified. The behavior of a Cu surface reduced with H and of a Cu surface loaded with water vapor was especially investigated. (*In German.*) Elektronenbefreiung durch energiearme Ionen an gasbedeckten Metalloberflächen. – Hans Fetz, Arnulf Diener, and Erich Meyer. *Zeitschrift für Angewandte Physik*, v. 13, no. 6, June 1961, p. 292-295.

Transport Phenomena in a Fully **Ionized Gas** Confined in a Strong Magnetic Field – The effects of drifts of guiding centers caused by the spatial nonuniformity of a magnetic field and/or by a static electric field in the presence of a uniform **magnetic field** are investigated. – Toyoki Koga. *Physics of Fluids*, v. 4, no. 7, July 1961, p. 834-841.

• A Limiting Process in **Quantum Electrodynamics** – It is shown that the interaction between two **charged particles** reduces to that of a potential with one particle when the mass of the other tends to infinity. Recoil corrections when one of the masses is finite and large is also estimated in the case of two-fermion scattering and bremsstrahlung in two-fermion interaction. – Alladi Ramakrishnan, G. Bhamathi, and S. Indumathi. *Indian Academy of Sciences, Proceedings*, v. 53, sec. A, no. 4, Apr. 1961, p. 206-213.

Interaction of a **Quantum Plasma** With Electromagnetic Fields – The g.m.d.f. approach is extended to obtain the response of a quantum plasma to classical transverse **electromagnetic fields** as well. The interaction is treated in a self-consistent-field approximation. – Hugo Wahlquist. *California Institute of Technology, Jet Propulsion Laboratory, Technical Report No.* 32-81, Mar. 15, 1961, 14 pp. (TL501 C12.4t Contin.)

Proceedings of the Sixth Symposium on **Magnetism** and **Magnetic Materials** – Papers cover ordered spin systems, computer devices, spin configurations, metallic films, nuclear hyperfine fields, ferromagnetic resonance high coercive materials, exchange interactions and nonlinear microwave processes, magnetization processes and fine particles, anisotropy, domain walls and domain wall motion, microwave devices, metals and alloys, soft magnetic materials, and oxides. – v. XXXII. 399 pp. 1961. McGraw-Hill, New York. (QC753 Am35c Over.)

Proceedings of the Fourth International Conference on **Ionization Phenomena** in **Gases,** (Uppsala 17-21 August 1959) – About 250 papers in the following areas: fundamental processes in gas discharges; different types of discharges and applications; theoretical and experimental studies in plasma physics; and production, confinement, and heating of plasmas. – N. Robert Nilsson, editor. v. I-II. 551 and 656 pp. 1960. North-Holland Publishing Co., Amsterdam. (QC702 In8p Over.)

High-Resolution **Kinetic Spectroscopy** by a **Multiple-Flash Method** – Experiments are described in which double-beam absorption measurements are made at high spectral resolution (better than 0.05A in the visible and near ultraviolet) at an accurate sequence of time intervals as short as 200 μsec. This is accomplished with a high-resolution monochromator and dual-photomultiplier detector using a stroboscopic xenon flash source. Signals representing the absorption ratios are recorded on magnetic tape and read out with a digital integrator. – Henry H. Kramer, Maurice H. Hanes, and Edward J. Bair. *Optical Society of America, Journal*, v. 51, July 1961, p. 775-779.

Our new format should help you scan the page quickly. Boldface clue words identify subject matter. Titles appear unchanged at the beginning of each abstract.

• On Solving the Equation of **Radiative Transfer** for Conservative Non-Uniform Media – The equation of radiative transfer in a form suitable for non-uniform semi-infinite media in radiative equilibrium is solved for the attenuation coefficient χ compatible with models for total intensity J as functions of two variables, subject to the boundary condition of zero inward flux at the surface. – P. R. Wilson. *Australian Journal of Physics*, v. 14, no. 1, Mar. 1961, p. 57-63.

• An Investigation of the Electrical Resistance of **Cerium, Lanthanum,** and **Neodymium** at Pressures up to 250,000 kg/cm^2 – This work is a continuation of the author's work on the systematic study of **electrical resistance** of metals. It was established that all 3 elements: Ce, La, and Na possess a minimum electrical resistance in the pressure range 50,000 - 100,000 kg/cm^2. The change in resistance was studied in a high pressure chamber; pressures up to 250,000 kg/cm^2 were obtained. All measurements were carried out at room temperature. (*In Russian.*) Issledovanie elektricheskogo soprotivleniia tseriia, lantana, and neodyma pri davleniiakh do 250,000 kg/cm^2. – L. F. Vereshchagin, A. A. Semerchan, and S. V. Popova. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 5, 1961, p. 1059-1061.

• The Use of **Thermoelectric Effects** During **Crystal Growth** – Considers the use of **Peltier cooling** to increase the steady-state rate of crystallization V cm^3 sec^{-1} of a semiconductor growing from a melt. – J. R. O'Connor. *Electrochemical Society, Journal*, v. 108, July 1961, p. 713-715.

PLASTICS

• Kinetic Study of Polymerization of **Isoprene** in Hexane by Sodium and Potassium – The **polymerization** of isoprene in hexane **by Na and K** in fine suspension results after filtration in solutions of macroorganoalkalis which can start the polymerization of new amounts of isoprene. The speeds of polymerization are studied as a function of temperature and of the macroorganoalkali concentration whose association is demonstrated. (*In French.*) Étude cinétique de la polymérisation de l'isoprène dans l'hexane par le sodium et le potassium. – Jean Minoux. *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 252, no. 26, June 26, 1961, p. 4163-4165.

Straining Behavior of **Cellulose Acetate** Plastics — The relationship between flow **strain** and deformation strain of cellulose acetate plastics is examined for various conditions of working and annealing temperatures, magnitude of worked strain, rate of tensile strain, and amount of plasticizer. These strain characteristics are discussed and related to "box type" and "wedge type" relaxation spectra, respectively. — Katsuhiko Ito. *Modern Plastics*, v. 38, no. 11, July 1961, p. 129 + 3 pages.

a

• Inorganic-Organic High Polymers, Phenoxyaldehyde Resins of Titanium (IV) and Hafnium (IV) — Describes preparation of Hf and Ti phenoxide **high-temperature resistant resins.** It also suggests the possibility of combining such exotic elements as Cb and Ta into copolymers of phenolic derivatives. — R. J. Landry and E. H. Bartel. *SPE Transactions*, v. 1, no. 3, July 1961, p. 139-142.

b

• **Thermal Degradation** of Organic Polymers — Discusses thermal degradation of polymers from 200-1200 C and investigates some of the mechanisms involved. — Samuel L. Madorsky. *SPE Journal*, v. 17, July 1961, p. 665-671.

c

• **Cationic Polymerization** and Copolymerization of Anethole — Polymerization of trans-**anethole** at a low temperature in toluene, started by B fluoride etherate allowed the production of soluble polyanetholes having high molecular weights. The **copolymerization** of anethole is possible with many monomers. (*In French.*) Polymérisation et copolymérisation cationques de l'anéthole. — Pierre Sigwalt. *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 252, no. 25, June 19, 1961, p. 3998-4000.

d

• Studies on the Mechanism of **Radiation Polymerization.** II. Mechanism of the **Carbonium** Polymerization of Styrene and Methylmethacrylate Initiated by Gamma Rays — Gamma-ray induced copolymerization of **styrene** and methyl methacrylate in ethyl-chloride solution has been studied at monomer concentration 2.0 mole/1. and temperatures ranging from +25 to −78 C. The dose rate was 110 rad/sec. The relative amount of the styrene component of the copolymer increased with lowering of the temperature from +25 to 78 C. The styrene-**methyl-methacrylate** copolymers are sharply enriched in styrene at −78 C for all monomer mixtures. A sharp inhibition of styrene polymerization is observed when small amounts (ca.0.1 mole) of methyl methacrylate are added to the former. On radical polymerization styrene retards polymerization of methyl methacrylate. Data on the copolymer composition and kinetic data lead to the conclusion that copolymerization of styrene and methyl methacrylate at low temperatures initiated by gamma rays proceeds by means of a carbonium mechanism. (*In Russian.*) Izuchenie mekhanizma padiatrsionnoĭ polimerizatsii. II. O mekhanizme karbonievoĭ polimerizatsii stirola i metilmetakrilata pod deĭstviem gamma-luchei — M. K. Iakovleva, A. P. Sheĭnker, and A. D. Abkin. *Vysokomolekuliarnye Soedineniia*, v. 3, no. 6, June 1961, p. 828-832.

e

• The Mechanochemical Breakdown of **Polystyrene** by Vibromilling — The investigation presented here, including detection of nitrogen, the viscometric investigation, melting point determinations, the ultraviolet and infrared spectra, proves that macroradicals are formed in the **mechanochemical breakdown** of polystyrene by **vibromilling.** The slight differences between N_2 and NO milling may be ascribed in part to a more rapid deactivation of the radicals. — H. Grohn and K. Bischof. *Rubber Chemistry and Technology*, v. 34, no. 2, Apr.-June 1961, p. 474-481.

f

• The Molecular Structure and Mechanical Properties of **Polyethylene Terephthalate Fibers** — In considering the **dynamic mechanical properties** of PET and their relationship to the **molecular structure,** two main points have been investigated: first, whether the dynamic mechanical transitions can be related to specific motions of the molecular chains, and second, whether the influence of crystallinity and orientation can be simply understood. — I. M. Ward. *Textile Research Journal*, v. 31, July 1961, p. 650-664.

g

Self-Plasticized Phenolic Resins — The principle of steric hindrance by suitable alkyl substituents is employed to reduce the hydrogen bond-forming ability of a cured phenolic resin. Resulting products in the form of laminates can be punched cleanly at room temperature in sufficient thickness to be of interest as base materials for use in printed circuits. Because

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they contain no added low molecular weight ingredients as plasticizers, the laminates are free of the customary blistering, solvent extraction, and other difficulties normally associated with a migratory additive. The most effective substituent is indicated to be the meta-isopropyl group. The same polymers may also be made into a satisfactory grade of postformable laminate, free of added plasticizer. — James H. Freeman and Edward J. Traynor. *Industrial and Engineering Chemistry*, v. 53, July 1961, p. 573-574.

i

Reinforced Plastics for **Corrosive Service.** II — A guide to the design of chemical process equipment. The selection of resins and reinforcing materials for various services, including methods of testing and fabrication. — Robert M. Webster. *Chemical Engineering*, v. 68, July 10, 1961, p. 168 + 2 pages.

j

Source Book of the New Plastics — This new addition presents the significant information on the important new plastics; their properties, production, price, application, and selection. An outstanding feature is the chapter on technical progress, which includes articles on stereospecific catalysts, block and graft polymers, fluorocarbon nomenclature, Montecatini developments, and urethane foam progress. — Herbert R. Simonds, editor. v. II. 310 pp. 1961. Reinbold Publishing Corp., New York. (TP986.A2 Si56s)

k

• Polymerization of **Methylmethacrylate** on Electrolytic Reduction of Oxygen — Purpose of work has to determine **polymerization** conditions for methyl ester of the methacrylic acid in acid solutions on the Hg cathode. The results were obtained during the electrolytic reduction of O. (*In Russian.*) Polimerizatsiia metilmetakrilata pri elektrovossta novlenii kisloroda. — A. I. Fedorova, I. V. Shelepin, and N. B. Moiseeva. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 1, May-June 1961, p. 165-168.

Paper-Plastic Combinations — Paper-plastic combinations; why they are used, how they are used at present, what we can expect in the future. Excerpts of a paper presented at First Waste Paper Symposium, Chicago, June 7-8, 1960. — R. B. Gillett. *Paper Mill News*, v. 84, no. 28, July 10, 1961, p. 16-17.

Acrylonitrile—Petrochemical Prodigy — **Acrylonitrile manufacturing** processes, chemical reactions, and end-use markets are summarized. — D. W. McDonald, K. M. Taylor, and D. M. Brown. *Petroleum Refiner*, v. 40, July 1961, p. 145-154.

POLLUTION AND WASTES

• **Air Pollution** as Determined by Corrosion Rates in Test Materials — Some of the corrosive effects of atmospheric pollutants may be evaluated by means of a relatively simple **corrosion rate test** based on the weight gain that occurs when an iron disc is exposed to the atmosphere for a few weeks. The weight gain is due to the formation of corrosion products on the surface of the test material. Field tests are easily performed, and a minimum of laboratory equipment is required for analysis of samples. Consequently, this furnishes an inexpensive method to determine relative corrosion rates in different areas of a community, as well as trends in corrosion rates over a period of years. — William C. Galegar and Roy O. McCaldin. *American Industrial Hygiene Association Journal*, v. 22, no. 3, June 1961, p. 187-191.

• A Review of the Literature of 1960 on **Wastewater** and **Water Pollution Control** — H. Heukelekian, et al. *Water Pollution Control Federation, Journal*, v. 33, July 1961, p. 681-710.

RELIABILITY ENGINEERING

Instrumentation and **Reliability** — R. E. Fischbacher. *Control*, v. 4, no. 37, July 1961, p. 87-90.

Improving **Reliability** Through Packaging — **Electronic packaging** is as old as electronics itself. But adverse environments and higher reliability, typical of our missile age, have placed unusual demand on packaging. Now, new materials and techniques are meeting the challenge. Here we present complete design information. — D. F. Christensen and M. E. Nelson. *Electronic Industries*, v. 20, July 1961, p. 106-109.

• **Digital-Circuit Reliability** Through **Redundancy** — The use of standby components and complete standby **circuits** to minimize the probability of error and failure of operation over long periods of time. — Albert A. Sorensen. *Electronic-Technology*, v. 68, no. 1, July 1961, p. 118-125.

RUBBER AND ELASTOMERS

• Effect of Temperature on the Ultimate High Elastic Deformation and Strength of a **Rubber Solution** — The ultimate **high elastic deformation** and **structure strength** of a 2% natural rubber solution undergoing deformation at constant rate of 143 sec^{-1} has been investigated over the temperature range 90 to −35°. The reversible deformation has been shown to increase in value from 750% to 6700% on lowering the temperature to −25 C, after which it decreases to 2500% at −35 C. The increase in high elastic deformation has been attributed to the formation of nodes between chains as a result of crystallization processes. The temperature dependence of the characteristic parameters has an exponential shape, the exponent changing at temperatures in the vicinity of 20 C for the strain parameters and at lower temperatures for the stress. The curve depicting the relation between the stress and over-all or elastic strain consists of four sections, characterizing the shear modulus and belonging to different stages of deformation of the coil structures. (*In Russian.*) Uliianie temperatury na naibol'shuiu vysokoelastichеskuiu deformatsiiu i prochnost' struktury rastvora kauchuka. — A. A. Trapeznikov. *Vysokomolekukiarnye Soedineniia*, v. 3, no. 6, June 1961, p. 811-819.

Cast Flexible Urethane Polymers — An investigation was undertaken to determine the effect of **molecular structure** on **physical and electrical properties** of polyester-based cast urethane polymers. The polyesters were prepared from adipic acid and various short chain diols. These polyesters were then converted to isocyanate-terminated prepolymers through reaction with three commercially available aromatic diisocyanates. The prepolymers were reacted with anhydrous 1,4-butanediol to form cast urethane products, whose physical and electrical properties were determined. The relation between structure and properties is discussed. — C. H. Smith and C. A. Peterson. *Modern Plastics*, v. 38, no. 11, July 1961, p. 125 + 3 pages.

• The Chemistry of **Natural Rubber Production** — Latex particles, bacteria in the tree and in latex, latex preservation, drying of rubber coagulum, changes in hardness of rubber on storage, S.P. rubbers, graft polymers, *cis-trans* isomerism, and biosynthesis of rubber are discussed. — W. G. Wren. *Rubber Chemistry and Technology*, v. 34, no. 2, Apr.-June 1961, p. 378-412.

• **High Solids SB-R Latex** by a Chemical Promoted **Agglomeration** — L. H. Howland, E. J. Aleksa, R. W. Brown, and E. L. Borg. *Rubber and Plastics Age*, v. 42, July 1961, p. 868 + 4 pages.

The Effect of Temperature on the Air Aging of **Rubber Vulcanizates** — The changes that occur on the **air aging** of vulcanizates of GR-S, nitrile rubbers, and neoprenes over the temperature range of room temperature to 150 C appear to be essentially the same at all temperatures, the rate of change depending on the temperature in a regular way. The apparent activation energies calculated from the available data are 19,000 ± 2000 cal per mole. — A. E. Juve and M. G. Schoch, Jr. *Materials Research & Standards*, v. 1, July 1961, 542-545.

• Polycondensation as a Means of Producing **Polydialkylsiloxane** and **Polyalumodialkylsiloxane** Elastomers — A new synthesis based on the **polycondensation** of difunctional oligomers with difunctional silicon organic monomers is considered. This process is accomplished in two stages. First stage consists of the oligomer production by well known methods. In the second stage the oligomers obtained are subjected to a polycondensation. (*In Russian.*) Polikongeneatsiia kak metod polycheniia polidialkiloksanovykh i polialinmodialkiloksanovykh elastomerov. — K. A. Andrianov and A. A. Zhdanov. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 2, May 1961, p. 361-364.

What Goes Into Rubber? — Identifies the main **rubber ingredients** and tells what they do. — George McKenzie. *Product Engineering*, v. 32, no. 28, July 10, 1961, p. 62-64.

• A New **Petroleum-Derived Elastomer;** Its Characteristics and Applications — **"Dutral"**, an ethylene-propylene copolymer produced by "Montecatini", has a totally amorphous structure, and is virtually completely saturated; as such it has an excellent resistance to oxidation, light, heat, and chemical agents. It can be crosslinked by particular types of organic peroxides and diperoxides, preferably with sulfur added; it can generally replace conventionl rubbers in any of their applications, and by many viewpoints can be qualified as specialty rubber, with which it competes favorably in price. Physical and mechanoelastic properties of the elastomer are described; of particular interest are the low density and brittle-point. The principal, already tested applications are reviewed. (*In Italian.*) Un nuovo elastomero derivato dal petrolio; sue caratterististiche ed impieghi — Lamberto Berti. *Chimica e l'Industria*, v. 43, June 1961, p. 644-648.

SOLID MECHANICS

Characteristic Equations in the Theory of **Circular Cylindrical Shells** — Basic characteristic equations are derived for the boundary loading of thin circular cylindrical shells. For representation in a Fourier series circumferentially, the roots are computed for a small number of geometrical parameters over a wide range of "thinness" of the shell. For representation in a Fourier series longitudinally, roots are already available. Approximate forms put forward by other writers are compared briefly. — L. G. Jaeger and A. H. Chilver. Paper from "Nuclear Reactor Containment Buildings and Pressure Vessels", p. 369-378, 1960. Butterworth Inc., Washington 14, D. C. (TK9006 Sy68n)

Proceedings of the Society for Experimental **Stress Analysis** — B. E. Rossi and C. H. Willer, editors. *Society for Experimental Stress Analysis, Proceedings*, (Annual Volume), v. 18, no. 1, 1961, 208 pp. (TG265 So13p Vis.)

• Investigation of Failure of Three **Prestressed Concrete Piles** — Charles C. Zollman. *American Concrete Institute, Journal*, v. 58, no. 1, July 1961, p. 107-112.

The Southwell Method for Predicting **Critical Loads** of Elastic Structures — Shows that the Southwell method may be extended to the prediction of the elastic critical loads of **plane frameworks.** — S. T. Ariaratnam. *Quarterly Journal of Mechanics and Applied Mathematics*, v. 14, pt. 2, May 1961, p. 137-153.

• Design Constants for **Interior Cylindrical Concrete Shells** — To increase confidence in the use of the beam method for the analysis of interior cylindrical shells, and also provide data for those cases in which the beam method is not applicable, design constants for interior cylindrical shells, based on the shell theory, are presented. — A. L. Parme and H. W. Conner. *American Concrete Institute, Journal*, v. 58, no. 1, July 1961, p. 83-106.

• Tensile **Strength** and Diagonal Tension Resistance of Structural **Lightweight Concrete** — J. A. Hanson. *American Concrete Institute, Journal*, v. 58, no. 1, July 1961, p. 1-39.

A Design Guide: **Preventing Fatigue Failures.** VI. Biaxial Fatigue Stresses — Fatigue calculations may be complicated by the presence of multi-axial, alternating stresses. The problem can be simplified by relating these stresses to a single, allowable fatigue stress. — F. B. Stulen, H. N. Cummings, and W. C. Schulte. *Machine Design*, v. 33, July 6, 1961, p. 154-158.

Influence Coefficients of **Shallow Spherical Shells** — Solutions are obtained for the displacement and rotation of the edge of a shallow spherical shell acted upon by uniform surface pressure, edge forces, and moments. Special emphasis is placed on the behavior of these solutions as the shell approaches a flat plate. — H. E. Williams. *California Institute of Technology, Jet Propulsion Laboratory, Technical Report No.* 32-51, Feb. 21, 1961, 11 pp. (TL501 C12.4t Contin.)

Axisymmetric Edge Loading of Shells of Revolution – An approximate solution is presented for the stresses and deflections in a segment of a **shell of revolution,** acted upon by an axisymmetric set of horizontal shear forces and meridional bending moments applied on the edges. – H. E. Williams. *California Institute of Technology, Jet Propulsion Laboratory, Technical Report No.* 32-50, Feb. 20, 1961, 20 pp. (TL501 C12.4t Contin.)

Axisymmetric Pressure Loading of Thin Shells of Revolution: Approximate Membrane Solution – The **membrane solution** for a uniformly pressurized, constant-thickness thin **shell of revolution** is evaluated as it applies to the interior and near the edge of the shell. – H. E. Williams. *California Institute of Technology, Jet Propulsion Laboratory, Technical Report No.* 32-52, Feb. 28, 1961, 18 pp. (TL501 C12.4t Contin.)

WADC-University of Minnesota Conference on **Acoustical Fatigue** – Papers cover characteristics of noise fields, properties of materials, and structural configurations which affect acoustical fatigue life, response to vibration, and noise of structures with idealized properties, engineering experience, and relative importance of various parameters in acoustical fatigue. – W. J. Trapp and D. M. Forney, Jr., editors. *U. S. Air Force, Wright Air Development Division, WADC Technical Report* 59-676, Mar. 1961, 494 pp. (TL507 Un3.18w Vis.)

A Comparison of the **Brittle Behavior** of Metallic and Nonmetallic Materials – Discusses basic influences on brittle behavior and compares elastic, plastic deformation, fracture, notch sensitivity, energy absorption, fatigue, and thermal-shock properties of metals, ceramics, and plastics. – G. T. Hahn and R. I. Jaffee. *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 107, May 16, 1961, 33 pp. (TN799 B32.2d Contin.)

Progress in Solid Mechanics – A text book concerned primarily with the **properties and deformations of elastic-plastic solid bodies.** – I. N. Sneddon and R. Hill, editors. v. II. 31 pp. 1961. Interscience Publishers Inc., New York. (QC125 P94)

Model Investigations of Unstiffened and Stiffened **Circular Shells** – Describes test techniques used in evaluation of the effect of **internal pressure** on stability of shells used in modern aircraft and missiles. – L. A. Harris, H. S. Suer, and W. T. Skene. *Experimental Mechanics,* v. 1, July 1961, p. 1-9.

SOLID STATE PHYSICS

• Differential **Ferroelectric Properties** in Different Regions of **Rochelle-Salt Crystals** – In single crystals of Rochelle salts the various regions differ by their dielectric properties (Curie temperature, maximum dielectric constant, shape of the hysteresis loop). Each region consists of the crystal parts where during growth the material has accumulated on the same crystal surface. Chemical and structural formations of holes are assumed as the causes of the different properties. The effects of a low ammonium-Na, tartrate addition are examined. (*In German.*) Unterschiedliche ferroelektrische Eigenschaften in verschiedenen Gebieten von Seignettekristallen. – Horst Müser and Hans-Günther Unruh. *Zeitschrift für Physik,* v. 162, no. 3, 1961, p. 313-328.

• Field-Theoretic Approach to the Properties of the Solid State – The techniques of **quantum field theory** are used to investigate the **thermodynamic ion displacement** correlation function--or Green's function of the phonon field--in a crystal and especially in a metal. The structure of thermodynamic Green's function is outlined and the method for solving for them at finite temperature is fully discussed. The analytic structure of the phonon Green's function is then considered. This function is shown to be bounded and invertible everywhere off the real axis; a spectral form is derived for its inverse. The symmetries imposed by the point group of the crystal are then discussed. – Gordon Baym. *Annals of Physics,* v. 14, July 1961, p. 1-42.

• The Modification of **Electron Energy Levels** by Impurity Atoms – The influence of localized **impurities in solids** may be represented either by the effect of randomly distributed classical scattering centers for which only averaged quantities are meaningful or, as proved herein, the effect of an equivalent quantum description which incorporates both the random character and the process of averaging. The results of these approximations are compared with the exact results obtained by Frisch and Lloyd for a special model in which the impurity potential may be represented as an attractive one-dimensional delta-function. One of the approximations discussed is a direct analog of the Brueckner model, and for the delta-function potential example this approximation can be solved exactly. – John R. Klauder. *Annals of Physics,* v. 14, July 1961, p. 43-76.

Thermoelectricity: Science and Engineering – This book attempts to cover the physics and chemistry of thermoelectric materials, the design of materials, and the device technology. – Robert R. Heikes and Roland W. Ure, Jr. 576 pp. 1961. Interscience Publishers, New York. (QC621 H36t)

• Effect of **Hydrostatic Pressure** on **Ionic Conductivity** of **Silver Chloride** – Up to 700 kg/cm² in the intrinsic and extrinsic ranges. The pressure coefficients of the conductivity were in good agreement with the calculated values, and it was revealed that the mobility is much affected by the applied pressure. – Kiyoshi Shimizu. *Review of Physical Chemistry of Japan,* v. 30, no. 2, 1960, p. 73-79.

• Effects of **Plastic Deformation** on the Properties of **Scintillation** of NaI(Tl) Crystal – The large single crystals of **NaI(Tl)** were produced by Stockbarger's and Kyropoulos' methods. The most adequate conditions for the growth of these crystals were studied. The thallium distributions in the crystal were measured, and the relation between the photon yield in the scintillation and the thallium concentration was also studied. On the other hand, the effects of the plastic deformation on the decay time and on the photon yield in NaI(Tl) scintillation were measured, and the reasonable models being responsible for the luminescent center of scintillator were discussed. – Masahiro Oura. *Review of Physical Chemistry of Japan,* v. 30, no. 2, 1960, p. 92-99.

Thermionic Conversion of Heat to Electricity – W. B. Nottingham, G. N. Hatsopoulos, and E. N. Carabateas. *Aero/Space Engineering,* v. 20, July 1961, p. 14 + 5 pages.

Paramagnetic Susceptibility of Polycrystalline Praseodymium Metal – The **paramagnetic susceptibility** of polycrystalline **praseodymium** metal has been measured between 300 and 1500 K. The measurements are in good agreement with the predictions of the Von Vleck theory of paramagnetism based on a localized *f*-electron model of noninteracting Pr^{3+} ions. By making a reasonable correction for the contribution of conduction electrons to the paramagnetism, a best fit to the experimental results is obtained by using a screening constant $\sigma = 34$. – Sigurds Arajs, R. V. Colvin, and J. M. Peck. *Journal of Chemical Physics,* v. 34, June 1961, p. 1959-1962.

Analysis of the **Absorption and Fluorescence Spectrum** of $NdCl_3$ Diluted With $LaCl_3$ – The Stark splitting of the identified levels of **Nd^{+3} in $LaCl_3$** were calculated by first-order perturbation. Intermediate coupling wave functions and crystal-field interaction parameters reported by Judd were used. The calculated spectrum agrees with the spectrum observed by Carlson to 5 cm^{-1}. – Eugene Y. Wong. *Journal of Chemical Physics,* v. 34, June 1961, p. 1989-1993.

Electrical Properties of Organic Solids. IV. Charge Carrier Diffusivity in Metal-Free Phthalocyanine – The **pulsed light technique** has been applied to determine the **charge carrier mobility** in microcrystalline or amorphous, metal-free **phthalocyanine** layers. – David R. Kearns and Melvin Calvin. *Journal of Chemical Physics,* v. 34, June 1961, p. 2022-2025.

Color Centers in **ZnS Single Crystals** – Absorption bands induced in ZnS crystals by uv (0.366μ) are described. The two main absorption bands peaked at or below 0.6μ and at 1.2μ. Two weaker bands at 0.8 and 1.35 appear as shoulders of the main bands. Thermal and optical bleaching properties are also described, and the results are shortly discussed in light of a formerly proposed model. – A. Halperin and R. Pinker. *Journal of Chemical Physics,* v. 34, June 1961, p. 2031-2034.

• Study of the **Saturation** and Measurement of the **Relaxation Time** in the Ferrimagnetic Resonance of **Yttrium Garnet** – The saturation processes were explained on the basis of the studies of Suhl and Schlömann and the effetcs of the different para-

meters on the width of the absorption band were analyzed. The principle of the measurement of M_x and χ'' was indicated and the experimental device was described in detail. (*In French.*) Étude de la saturation et mesure du temps de relaxation dans la résonance ferrimagétique du grenat d'yttrium. – Michel Sauzade. *Annales de Physique*, v. 6, ser. 13e, nos. 5-6, May-June 1961, p. 595-642 + 1 plate.

• Critical Study of the Variation of the Optical Constants of **Thin Layers of Semiconductors** as a Function of Thickness – Examines the anomaly of the **optical constants** of thin layers, for a critical thickness of the order of 1000 Å, from the point of view of its relation with the **multiwave interferences** inside a layer, and reaches the conclusion that the anomaly is real. (*In French.*) Étude critique de la variation des constantes optiques de couches minces de semi-conducteurs en fonction de l'épaisseur. – Guy Perny and Rémy Lorang. *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 252, no. 26, June 26, 1961, p. 4137-4138.

Theory of **Domain Walls** in **Ordered Structures.** I. Properties at Absolute Zero – J. W. Cahn and R. Kikuchi. *Physics and Chemistry of Solids*, v. 20, nos. 1-2, June 1961, p. 94-109.

Current-Induced Marker Motion in **Copper** – Measurements of **marker motion** in Cu have been made from 785 to 1040 C. The technique resembled that used for previous experiments with Au. – A. R. Grone. *Physics and Chemistry of Solids*, v. 20, nos. 1-2, June 1961, p. 88-93.

Current-Induced **Marker Motion** in Gold Wires – The motion of light transverse scratches, used as markers, has been observed on the surface of **gold wires** carrying current densities of about $10^4 A/cm^2$ for periods of several days. – H. B. Huntington and A. R. Grone. *Physics and Chemistry of Solids*, v. 20, nos. 1-2, June 1961, p. 76-87.

Magnetic Short Range Order and **Specific Heat** in **Ferromagnets** and **Antiferromagnets** – J. S. Smart. *Physics and Chemistry of Solids*, v. 20, nos. 1-2, June 1961, p. 41-49.

New Concepts in **Thermoelectric Device Design** – The effects of the thermal and electrical circuit on entropy production within the device are considered. The design problem is analyzed by comparing the relative contribution of various parts of the system to the total entropy production. – W. H. Clingman. *I.R.E. Proceedings*, v. 49, July 1961, p. 1155-1160.

Molecular Electronics and Microsystems – The molecular electronics approach to **microsystems** considers the electronic function to be performed, then attempts to synthesize its characteristics within a suitable solid material. It is expected that this approach will lead to many new concepts in the realization of electronic functions. – J. P. Stelmak, Gene Strull, and H. C. Lin. *Electrical Engineering*, v. 80, July 1961, p. 504-515.

Some Recent Developments in **"Integrated Electronics"** – Integrated electronics characterizes **microsystems** in which the number of parts are considerably less than the number of equivalent components. Some of the steps in the development of microsystems leading to the process of integrated electronics are briefly described and illustrated by several working devices. – Harry Kihn. *Electrical Engineering*, v. 80, July 1961, p. 488-499.

New Techniques for Producing **Ultrapure Semiconductors** – Reports new techniques, new demands for production of low-impurity materials. – Thomas Maguire. *Electronics*, v. 34, no. 27, July 7, 1961, p. 41-45.

Dielectric Properties of **$BaTiO_3$ Single Crystals** in the **Paraelectric State** From 1 kc/sec to 200 Mc/sec – E. Stern and Allen Lurio. *Physical Review*, v. 123, 2nd ser., no. 1, July 1, 1961, p. 117-123.

Mechanism of **Impurity Conduction** in Semiconductors – A new mechanism of impurity conduction in **semiconductors** at **low temperatures** is proposed. The conductivity is thought of as due to the carrier jumps over the Coulomb potential wall from the occupied impurity centers to the empty ones. – Jerzy Mycielski. *Physical Review*, v. 123, 2nd ser., no. 1, July 1, 1961, p. 99-103.

Tunneling From an Independent Particle Point of View – A method, developed for calculating wave functions through regions of varying band structure, is applied to tunneling problems using the **transition-probability approach** of Bardeen. – Walter A. Harrison. *Physical Review*, v. 123, 2nd ser., no. 1, July 1, 1961, p. 85-89.

Alternative Approach to the Solution of Added **Carrier Transport** Problems in **Semiconductors** – A novel method of solving the above is presented where equations embodying conservation of flux (again with due allowance for generation and recombination) which incorporate the proper boundary conditions from the outset are solved in the steady-state one-dimensional case to yield a Green's function for the desired carrier fluxes directly. – J. P. McKelvey, R. L. Longini, and T. P. Brody. *Physical Review*, v. 123, 2nd ser., no. 1, July 1, 1961, p. 51-57.

Space Dispersive Properties of **Plasma** – Using an approach based on the Doppler effect, the macroscopic parameters of a plasma have been represented in the form of four-dimensional tensors of the fourth order. – Jacob Neufeld. *Physical Review*, v. 123, 2nd ser., no. 1, July 1, 1961, p. 1-10.

• **Electroluminescence** in **Zinc Sulfide** As Due to Minority **Carrier Injection** – The purpose of this paper is to present experimental evidence in support of the proposition that the well-known electroluminescence in zinc sulfide is actually due to minority carrier injection, rather than to acceleraton and collision of majority carriers. – W. A. Thornton. *Electrochemical Society, Journal*, v. 108, July 1961, p. 636-645.

• The Preparation and Properties of Some II-V Semiconducting Compounds – The methods of **purification** and **single crystal growth** of six II-V semi-conducting compounds are discussed and **crystallographic data** are presented. The six compounds, representing three stoichiometries, are **Cd_3As_2, $CdAs_2$, CdSb, Zn_3As_2, $ZnAs_2$,** and **ZnSb.** – G. A. Silvey, V. J. Lyons, and V. J. Silvestri. *Electrochemical Society, Journal*, v. 108, July 1961, p. 653-658.

Plasma as a **Microwave Amplifier** – A mechanism is postulated for which a streaming plasma may transmit energy to a traversing radiation field, and thereby enhance the signal. For a laboratory plasma, only resonance frequencies over a narrow band may be amplified by this method. Large amplification over a broad frequency range is postulated for an astronomical gas. – S. Rand. *Physics of Fluids*, v. 4, no. 7, July 1961, p. 860-865.

IRE Standards on **Piezoelectric Crystals:** Measurements of Piezoelectric Ceramics, 1961 – *I.R.E. Proceedings*, v. 49, July 1961, p. 1161-1169.

• An Investigation of the **Magnetic Susceptibility** of **Polyalkanopolyferrocenes** and **Polyferrocenylenes** – (*In Russian.*) Issledovanie magnitnoi vospriimchivosti polialkanopoliferrotsenov i poliferrotsenilenov. – A. N. Nesmeianov, et al. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 1, May-June 1961, p. 125-126.

• **Radiographic Investigation** of Light Substance Compression by **Slanting Collision** of Shock Waves – Describes a method to study the regular conditions of slanting reflection or collision of **shock waves** in solid and liquid bodies, such as Mg, Al, light atom compounds penetrable to X-rays, water, paraffin, and plexiglass. The method is used in determining the pressures and densities in the domain of stepped "repeated" compression behind the front of the shock waves reflected. (*In Russian.*) Rentgenograficheskoe issledovanie szhimaemosti legkikh veshchestv pri kosom stolknovenii udarnykh voln. – L. V. Al'tshuler and A. P. Petrunin. *Zhurnal Tekhnicheskoĭ Fiziki*, v. 31, no. 6, June 1961, p. 717-725.

• **Optical Absorption** in Polycrystalline CdS Layers – Absorption spectra were found for the **cadmium sulfide films** obtained by evaporation in vacuum, H_2S and argon. Absorption was measured in the region 250-500 mμ. (*In Russian.*) Opticheskoe pogloshchenie polyeristallicheskikh sloev CdS. – K. V. Shalimova, T. S. Travina, and L. L. Golik. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 1, May-June 1961, p. 90-92.

• **Photoconductivity** of Polycrystalline **CdS Layers** – The problem was the study of photoconductivity of polycrystalline layers of CdS in the wide range of wavelengths of exciting light depending on the technological condition of the sample preparation. (*In Russian.*) O fotoprovodimosti pollikrystallicheskikh sloev sul'fida kadmiia. – K. V. Shalimova, T. S. Travina, and R. R. Rezvyi. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 2, May 1961, p. 334-337.

Masers for **Radar** Systems Applications – This paper is intended to provide the systems engineer with a practical introduction to the use of solid-state maser **amplifiers** in radars. Various environmental problems involved in the successful application of masers are discussed. An elementary survey of reflection-cavity and traveling-wave masers, together with some experimental results are presented. Another section treats the problem of saturation in masers and discusses some of the methods available for protecting masers from the TR leak-through pulses in radar. Progress made in the development of open- and closed-cycle liquid helium cryogenic systems suitable for masers is described. The authors' personal evaluations of the state of the art of ruby masers and closed-cycle helium refrigerators are given in appendixes. – H. R. Senf, F. E. Goodwin, J. E. Kiefer, and K. W. Cowans. *IRE Transactions on Military Electronics*, v. MIL-5, no. 2, Apr. 1961, p. 58-65. (TKI In6.6mi Contin.)

Our new format should help you scan the page quickly. Boldface clue words identify subject matter. Titles appear unchanged at the beginning of each abstract.

Thin **CsI (Tl) Scintallating Layers** Produced by **Vacuum Deposition** – In the scintillation counting of particles of the lowest detectable energy in the presence of particles of much higher energy, the problems inherent in amplifier overload, base line shift, etc., may be circumvented by using sufficiently thin scintillators. The preparation by vacuum deposition, of CsI(Tl) layers of thicknesses around 10^{-3} mm and of Tl contents from 0.1 to 90% is described and the scintillating ability upon α-particle excitation evaluated. – Gunnar Aniansson. *Kungliga Tekniska Högskolans Handlingar*, no. 176, 1961, 22 pp. (T4 K96t Vis.)

• Measurements on the **Magnetic Anisotropy** in Evaporated **Iron Films** – Examination of the problem of the magnetic anisotropy in evaporated iron films by use of the magneto-optic Kerr effect method reveals that there exists a weak anisotropy in some iron films coming from mechanical tensions. – R. Vrambout and L. De Greve. *Applied Scientific Research, Sec. B, Electrophysics, Acoustics, Optics, Mathematical Methods*, v. 9, no. 2, 1961, p. 102-106.

Adjustable-Frequency AC Drive System With **Static Inverter** – Solid-state components supply ac power and control its frequency in a new **electric drive system.** – C. G. Helmick and Ian M. MacDonald. *Westinghouse Engineer*, v. 21, no. 4, July 1961, p. 123-126.

• **Atom Scattering Factors** and Electron Density Distribution in **Gallium Antimonide** – Atom scattering factors of helium and antimony ions were determined and a picture of the distribution of **electron density** in the lattice of GaSb was obtained. (*In Russian.*) Atomnorasseivaiushchie faktory i raspredelenie elektronnoi plotnosti v antimonide galliia. – N. N. Sirota and E. M. Gololobov. *Akademiia Nauk SSSR, Doklady*, v. 138, no. 1, May-June 1961, p. 162-164.

SPACE HEATING AND CONDITIONING

Cleaning Home Air Electronically – (New unit designed for ductwork installation and based on the principle of **electrostatic precipitation.**) *Metal Products Manufacturing*, v. 18, July 1961, p. 46 + 2 pages.

Portable Air Conditioner Cools Missile "Brains" During Countdown – Lester S. Ries. *Heating, Piping & Air Conditioning*, v. 33, July 1961, p. 113-115.

• Measured and Electrical-Model Characteristics of Buildings Heated by **Floor Thermal Storage** – E. D. Taylor, B. Berger, and G. Blaylock. *Institution of Electrical Engineers, Proceedings*, v. 108, pt. A, no. 39, June 1961, p. 226-238.

Humidity-Control in **Residential Air Conditioning Systems** – In most parts of the country, **humidity control** is required from two to four times as many hours as straight cooling. Recognizing these facts, it was evident that residential air conditioning equipment, capable of accomplishing "round-the-clock" comfort control, would assist greatly in developing the vast market potential that exists for summer air conditioning equipment. – R. L. Signorelli. *ASHRAE Journal*, v. 3, July 1961, p. 67-70.

• Air Conditioning the **Electronic Research and Development Center** – A successful **air conditioning system** for the R & D Center is the end result of a detailed study of design criteria, types of generating systems, methods of air distribution, degree of temperature control, first cost, operating cost, architectural appearance, and ease of maintenance. Herein are guidelines that will prove useful in such a study. – C. Stuart Perkins and Robert F. Coyne. *Air Conditioning, Heating and Ventilating*, v. 58, July 1961, p. 66-71.

• Electronic Air Cleaners and Their Application – **Electronic air cleaners** can be installed alone; they can be used with different types of prefilters; and they can be incorporated into cost-saving "air-recovery systems". This article discusses electronic air cleaners and these various applications. Included are installation and maintenance techniques, and a look at typical installations. – Weldon A. Smith. *Air Conditioning, Heating and Ventilating*, v. 58, July 1961, p. 57-60.

• Progress Report on **Off-Peak Electric Heating** – Storing of heat developed from electric energy during night and other off-peak hours and drawing on this heat during periods of heavy heat requirements is a subject of interest to both the heating engineer and the electric utility companies. Such a method makes it possible to reduce the daytime electric demand, and at the same time materially increase the annual load factor of the generating facilities. In some instances, it may enable the utility to offer an attractive off-peak energy rate. The author summarizes present methods actually in use. – E. R. Ambrose. *Air Conditioning, Heating and Ventilating*, v. 58, July 1961, p. 51-56.

• How to Reduce Building Costs By Combining Radiant Air System With New **Cellular Air Floor** – Sizeable savings in building space, volume, and operating costs can be obtained by utilizing available energy sources within the building in a **radiant air system** which uses a cellular air floor distribution. – Gershon Meckler, John S. Hickman, and Milton Meckler. *Air Engineering*, v. 3, no. 7, July 1961, p. 20 + 5 pages.

• A System for Conquering Inner Space – Describes a **prefabricated component** using **insulation board** as the basic product, but combining with it either hardboard or plywood faces. *Lumberman*, v. 88, July 1961, p. 58.

Mechanical Designs Aid Research for Better Drugs – A combination of high pressure dual duct and hot water heating and **air conditioning systems** plus a total of 10 separate piping systems serve a new **medical research laboratory** in Connecticut. Individual exhaust provisions to prevent cross contamination in animal rooms and other critical areas are an integral part of the air conditioning design. Sectionalization will allow future expansion without interrupting important work. – Lewis Smith. *Heating, Piping & Air Conditioning*, v. 33, Aug. 1961, p. 120-122.

TEXTILES, FIBERS, LEATHER, AND PAPER

• Flocculation at **Sedimentation.** V. Factors Influencing **Flocculation Tendency** – It is concluded that flocculation is a felting process, predominantly due to protruding fibrils on the surface of the fibers. – Olle Andersson. *Svensk Papperstidning*, v. 64, no. 11, June 15, 1961, p. 417-426.

• On the Fine **Structure of Polyamides.** III. The Effect of Liquid Baths on the Structure and the Properties of Various Spun Bristles and Fibres of **Polycaprolactam** – (*In German.* Über die Feinstruktur der Polyamide. III. Der Einfluss von Flüssigkeitsbädern auf die Struktur und die Eigenschaften

verschieden gesponnener Borsten und Fäden aus Polycaprolactam. – Christian Ruscher, Volker Gröbe, and Heinz Versäumer. *Faserforschung und Textiltechnik*, v. 12, May 1961, p. 214-222.

Dimensional Stability of **Wool Fabrics** – Margareta Cednäs. *Textile Institute, Journal, Transactions*, v. 52, June 1961, p. T251-T271.

• Improvement of Some of the Properties of **Sole Leathers** by Impregnation With **Polymers** – Joseph R. Kanagy. *American Leather Chemists Association, Journal*, v. 56, July 1961, p. 322-342.

Manual of **Man-Made Fibres.** Their Manufacture, Properties, and Identification – The chemical base, physical and chemical properties, stress-strain curves, dyeing method, identification test, and producer are given for each fiber. There is a world list of each man-made fiber producer, as well as a very extensive bibliography of all man made fibers covering manufacture, fiber properties, and uses. – Charles Z. Carroll-Porczynski. 304 pp. 1961. Chemical Publishing Co., Inc., New York. (TS1549 C23m)

• The Long Range Reorganization of **Gelatin** to the **Collagen** Structure – Arthur Veis, Joan Anesey, and Jerome Cohen. *Archives of Biochemistry and Biophysics*, v. 94, no. 1, July 1961, p. 20-31.

• Polynuclear and Related **Complexes of Chromium** and Their Possible Effects in **Tanning** – The effects of temperature, concentration, acidity, and time of aging have been studied for certain chromium(III)–oxyanion systems, by ion exchange, phase diagram, and other methods. Preliminary ion-exchange studies indicated the existence of various polynuclear species. More detailed batch studies employing resins of varying degrees of cross-linking showed that there was a large variation in size of some of these complexes. In certain favorable cases it has been possible to employ ion-exchange chromatography to achieve a satisfactory separation of complexes; in all cases the technique of gradient elution has been used. Probable structures have been assigned to these complexes. – J. P. Redfern and J. E. Salmon. *Society of Leather Trades' Chemists, Journal*, v. 45, June 1961, p. 232-242.

• The Effect of Crystalline Structure on the **Alkaline Degradation** of **Cellulose Fibers** – Alexander Meller. *Journal of Polymer Science*, v. 51, May 1961, p. 99-109.

• The Use of **Holocellulose** to Study **Cellulose** Supermolecular Structure – Russell Nelson. *Journal of Polymer Science*, v. 51, May 1961, p. 27-58.

• Basic Data for Dilute **Fiber Suspensions** in Uniform Flow With Shear – An investigation of the internal flow mechanics of different suspensions under laminar and turbulent shear and in relation to flow in **paper-making** machines. Three wood pulp and two synthetic fibers having a wide range of physical characteristics were employed in experimental determination of flow resistance, velocity distributions and turbulence as functions of concentration and flow rate. – James W. Daily and George Bugliarello. *Tappi*, v. 44, July 1961, p. 497-512.

• The Structure of Paper. II. The Statistical Geometry of a Multiplanar **Fiber Network** – It is shown that the elastic modulus, and the breaking load and stretch are linearly related to the mean number of fibers holding each fiber in the network, $\bar{c}_m$. These results suggest that $\bar{c}_m$ is a fundamental parameter through which paper and fiber properties can be interrelated. Thus, the theory of multiplanar sheet structure is possibly a basis for a science of **paper structure.** – O. Kallmes, H. Corte, and G. Bernier. *Tappi*, v. 44, July 1961, p. 519-528.

• The Mechanism of **Acid Bisulfite** Pulping. I. The Effects of Temperature Schedule and Chip Size on Pulping Rate – Shredded chips cooked more rapidly and to higher screened yields than mill-size chips in tests of **wood pulping** rates. With shredded chips and 30 minutes to maximum temperature, a screened yield of 50.6% was obtained in a total cooking time of 120 minutes. Mill-size chips could not be cooked satisfactorily at the rapid temperature schedule, maximum screened yields being less than 45%. – W. J. Nolan. *Tappi*, v. 44, July 1961, p. 484-493.

• Newsprint From Domestic **Timber Bamboo–Phyllostachys Bambusoides – Paper pulps** from **Phyllostachys bambusoides** for possible use in newsprint-grade papers were prepared experimentally by chemical, semichemical, and mechanical processes. Yields of 82% for cold soda semichemical and 62% for neutral sulfite pulps were realized. – T. R. Naffziger, T. F. Clark, and I. A. Wolff. *Tappi*, v. 44, July 1961, p. 472-475.

• Studies on the Mechanism of **Chlorine Dioxide** Bleaching – Reviews the possible reactions which lignin undergoes in **pulp bleaching.** – R. A. Murphy, K. Kakehi, and K. V. Sarkanen. *Tappi*, v. 44, July 1961, p. 465-467.

• Crystallization of **Cellulose** and Cellulose Derivatives From Dilute Solution. I. Growth of **Single Crystals** – B. G. Rånby and R. W. Noe. *Journal of Polymer Science*, v. 51, May 1961, p. 337-347.

• The **Cellulose-Butadiene Diepoxide Reaction** and Its Effect on the **Crease Resistance** of Cotton – John B. McKelvey, Ruth R. Benerito, Beverly G. Webre, and Ralph J. Berni. *Journal of Polymer Science*, v. 51, May 1961, p. 209-230.

• Factors Influencing Tensile Properties of **Cellulose Fibers** – A model for the structure of cellulose fibers is proposed. The effect of degree of polymerization (DP), lateral order, and orientation on tensile properties is discussed in the light of this model. A program was set up to determine separately the effects of the different factors on the **tensile properties** of various fibers. From this work parameters were derived to express these effects quantitatively in a manner that would be applicable to various types of cellulose fibers. – Hans Krässig and W. Kitchen. *Journal of Polymer Science*, v. 51, May 1961, p. 123-172.

• Recent Advances in Knowledge of the Structure of the **Collagen Fibril** and of the Properties of the **Tropocollagen** Macromolecule – The first John Arthur Wilson Memorial Lecture. – John H. Highberger. *American Leather Chemists Association, Journal*, v. 56, Aug. 1961, p. 422-456.

THERMAL MECHANICS

• New Method for the Treatment of **Gas Dynamic Problems** in the Case of Marked Deflections From the **Thermodynamic Equilibrium** – The purpose of the method is to obtain approximate solutions of the Boltzmann equation. The distribution of velocity used permits a better adaptation to the gas dynamic problem, or to the constantly recurring deviations of the velocity distribution from the balance distribution. An instance of steady compression shock was used in verifying the practicability of the method. (*In German.*) Ein neuer Ansatz für die Behandlung gasdynamischer Probleme bei starken Abweichungen vom Thermodynamischen Gleichgewicht. – Fritz Weitzsch. *Annalen der Physik*, v. 7, nos. 7-8, Mar. 1961, p. 403-417.

Résumé of **Transonic-Compressor** Research at NACA Lewis Laboratory – During the past decade, the **Lewis Laboratory** of the NACA was engaged in intensive research on the aerodynamics of high-performance axial-flow compressors. The focal point of this program, the development of the transonic compressor, is briefly reviewed, and the basic significance of the results is discussed. Following this, a résumé of succeeding experimental single and multistage investigations and analytical studies is given to indicate the scope of the work and the major results achieved. An extensive bibliography covering the research effort during this time is included. – Seymour Lieblein and Irving A. Johnsen. *ASME, Transactions, Series A, Journal of Engineering for Power*, v. 83, no. 3, July 1961, p. 219-234.

The **Philips Stirling Thermal Engine.** Analysis of the Rhombic Drive Mechanism and Efficiency Measurements – Contains a short history of the **hot-gas engine** and a discussion of the principle of the **Stirling system,** followed by a description of a new drive mechanism for the displacer-piston engine which offers great advantages in connection with the balancing of the engine and the reduction of the gas forces. Various calculations concerning this rhombic drive mechanism are given.

Some properties of the hot-gas engine are compared with those of the internal-combustion piston engine. – R. J. Meijer. *Philips Research Reports* (Suppl.), no. 1, 1961, 113 pp. + appendixes.

What Use for These **Unconventional Power Sources?** – A description of several laboratory ways to generate a voltage potential. – Charles J. Lynch. *Product Engineering*, v. 32, no. 28, July 10, 1961, p. 57-59.

• Some Data Concerning **Heat-Exchange** in the Combustion Chamber of a **Gas Turbine** Operating on Natural Gas – Purpose of this work was to obtain data on the temperature of the surface of a flame pipe as well as on the order of magnitude of radiant and convection heat flows, degree of blackness of the torch, and heat transfer coefficients in the **combustion chamber** during the **natural gas** combustion. (*In Russian.*) Nekotorye dannye po teploobmenu v kamere sgoraniia gtu pri szhiganii prirodnogo gaza. – M. A. Poliatskin, A. A. Shatil, Ia. S. Khainovskii, and V. N. Babkin. *Teploenergetika*, no. 7, July 1961, p. 68-72.

• Compact Engine Boosts Navy **Target Drone** – **Liquid rocket** being produced by Rocketdyne weighs only 17 lbs., produces 685-lb.-thrust for Beech's **XKD-2B-1**–a Mach 2 target which soars to 70,000 ft. in 22 sec. – Frank G. McGuire. *Missiles and Rockets*, v. 9, no. 6, Aug. 7, 1961, p. 22-23.

Simple Formulas for Stagnation-Point Convective Heat Loads in **Lunar Return** – Simple formulas are given for the **stagnation-point convective heat loads** in lunar return for two operational modes. The two modes of operation analyzed are typical of moderate heating and of nearly minimum heat loads, respectively. The values of the parameters in a simple two-parameter formula for the total-heat load are given in the lift-drag-ratio range of 0.2 to 1.0 and in the peak loading range of 2g to 10g. For vehicles having a lift-drag ratio near 0.5, which is typical of many proposed lunar return vehicles, the nominal mode had about 20% more absorption than the nearly minimum mode. – Frederick C. Grant. *U.S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-890*, July 1961, 21 pp. (TL570 Un3t Room 290)

• The Change in Torque of a **Gas Turbine** Stage Depending on the Speed of Rotation – Theoretical analysis of the relative magnitude of the torque. On the basis of experimental data is cited the dependence of the magnitude of the **torque** on various factors. (*In Russian.*) Izmenenie krutiashchego momenta stupeni gazovoi turbiny v zavisimosti ot skorosti vrashcheniia. – I. I. Kirillov. *Teploenergetika*, no. 7, July 1961, p. 18-24.

Exotic **Rocket-Propulsion** Systems – For long space flights, some form of ion, solar, plasma, nuclear, or **photon engine** will be used. Far from being "operational," these engines present many formidable problems of energy conversion and temperature containment. – F. J. Hendel. *Chemical Engineering*, v. 68, July 24, 1961, p. 135-142.

• Power for "Flying" 80-Ton **Hydrofoil.** II – Details of the vessel and its engines. – *Gas Turbine*, v. 2, no. 4, July-Aug. 1961, p. 27-29.

Boundary Layer Effects in **Magnetohydrodynamic Flows** – This research was sponsored by Project Squid through Contract No. Nonr 1858(25). This paper analyzes in some detail the growth of magnetohydrodynamic boundary layers, and the magnitude of the attendant electrical losses and heat transfer rates which might be expected in actual low-temperature MHD devices. The analysis, using integral methods, is made for constant velocity flow of an incompressible fluid over a flat plate in the presence of a uniform magnetic field normal both to the flow and the plate. Two different physical models are assumed; a hot wall case in which the electrical conductivity is supposed constant throughout the flow, and a cold wall case in which the conductivity is taken to be zero below a given temperature and constant but finite above that temperature. The latter model implies the existence of a layer of cold, non-conducting fluid near the wall, and more nearly approximates the real flow of an ionized gas over a cold surface than does the hot wall model. For each of these cases viscous and thermal thicknesses are found for both laminar and turbulent boundary layers, and the resulting losses are presented in graphical form. As a test of the assumptions made in the development of the theory, several comparisons are made with existent experimental data. – W. Craig Moffatt. *Massachusetts Institute of Technology, Magnetogasdynamics Laboratory Report*, No. 61-4, May 1961, 41 pp. + appendices. (QC809.M3 M38.55 Contin.)

WELDING AND JOINING

Inert Gas Shielded Metal Arc Welding of Thick Copper Without Preheat – Tests carried out on ½ in. **thick phosphorus-deoxidized Cu** show that the use of argon-nitrogen mixtures in place of pure argon enables preheat temperatures to be reduced, or welding speed to be increased. The application of the twin consumable electrode process to the downhand welding of ½ in. thick non-preheated Cu is demonstrated. – K. J. Clews. *British Welding Journal*, v. 8, July 1961, p. 353-359.

Metallurgical Concomitants of **Residual Stress** – It is shown that strain-aging, quench-aging, and other similar metallurgical changes that a steel undergoes during welding can most often cause the **embrittlement** that is ascribed to stress conditions. – G. M. Boyd. *British Welding Journal*, v. 8, July 1961, p. 343-348.

Investigation of Filler Materials for **Welding Al-Zn-Mg Alloys** – Describes work carried out mainly during the period 1953-56 with the object of devising a **filler material** for welding high-strength Al-Zn-Mg alloys of the type used in the British aircraft industry to specification DTD 683. – P. T. Houldcroft. *British Welding Journal*, v. 8, July 1961, p. 360-365.

Welding and Joining. New Applications of Explosives – Explosives are well established sources of power in metal-forming applications. Research shows that **explosive welding** and joining are also feasible. The author explains the theory of their use and the tooling required in these fields. – L. Zernow, I. Lieberman, and W. L. Kincheloe. *Tool and Manufacturing Engineer*, v. 47, no. 1, July 1961, p. 75-78.

• Electrode Melting and **Self Adjustment of the Arc in Welding** With Periodic Short-Circuitings of the Arc Gap – The process involving periodic short-circuitings of the arc weld occurs when a low voltage of the feeding source does not secure a passage of the current through the arc sufficient for the melting of the electrode with a speed equal to the speed of feed. The speed of melting of the electrode follows practically without hysteresis once the current has changed. The inductance of the welding current has much influence on the stability of the process. (*In Russian.*) Plavlenie elektroda i samoregulirovanie dugi pri svarke s periodicheskimi zamykaniiami dugovogo promezhutka. – Iu. L. Ishchenko and N. G. Diurgerov. *Svarochnoe Proizvodstvo*, 1961, no. 6, June, p. 9-12.

• **Inhomogeneity** of **Austenite** in the Welding of **Pearlitic Steel** by Melting – Studies the effects of the thermal cycle of welding on the inhomogeneity of austenite in the zone of recrystallization of pearlitic steels (steels 45, 40Kh, and 20Kh2MF); examines the kinetics of the inhomogeneity by measuring the microhardness after the specimens have been hardened from different temperatures of the thermal cycles of welding. The influence of the inhomogeneity of austenite on its stability is shown. The degree of inhomogeneity depends on the chemical composition of steel, the presence of carbide-forming elements and the initial structure, the techniques used, and the conditions of welding. (*In Russian.*) Neodnorodnost' austenita pri svarke perlitnoĭ stali plavleniem. – M. Kh. Shorshorov and B. A. Smirnov. *Svarochnoe Proizvodstvo*, 1961, no. 6, June, p. 1-5.

• The Use of **Radioisotopes** to Determine the Chemistry of **Solder Flux** – When rosin flux activated with amine halides is used in soldering printed circuit boards, metal halides are formed; these halides cannot be removed with organic solvents and thus may cause **corrosion.** The use of alkanol amines as solder fluxes was investigated. After soldering, the flux can be removed by rinsing with water. Throughout this investigation, radioisotopes were used to identify the compounds studied. – G. J. Sprokel. *IBM Journal of Research and Development*, v. 5, no. 3, July 1961, p. 218-225.